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CONTENTS:

	PAGE
Telephones and Parliament	161
Engines and Batteries for Power Stations.—II.	163
Parliamentary	163
Legal	168
Correspondence:—	
The Electrolytic Transmission of Sulphur	172
Machine Tools	172
Large Engines for Traction Work	173
Improved Testing Tank	173
Soldering Fluid	174
Electric Fitting for Baker's Oven	174
The Tramway Junction at Sheffield	174
The Conversion of Our Railways	174
London Electrical Contractors' Association	175
"Hatfield" Electrically-Driven Feed Pumps	175
The Testing and Management of Electric Motors	176
The L.C.C. Electric Tramways	176
Business Notes	177
Supply Station Accounts	186
City Notes	187
Traffic Receipts	190
Stocks and Shares	190
Share List of Electrical Companies	191
Market Quotations	192
Machine Tools at the Glasgow Exhibition (*illus.*) (*concluded*)	193
Standardisation of Engines and Dynamos (*illus.*) (*concluded*)	195
High Speed Steam Engines (*concluded*)	196
Our Legal Query Column	197
Dinner of the Institution of Junior Engineers	197
A New Telegraph Steamer ss. *Viking* (*illustrated*)	198
Reviews	199
Wireless Telegraphy *v.* Submarine Cables.—III.	201
New Patents	204
Abstracts of Published Specifications	204

THE

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TELEPHONES AND PARLIAMENT.

THE debate in the House of Commons on Monday evening enabled Sir James Dimsdale, as a member of Parliament, to carry out the work entrusted to him as Lord Mayor of the City of London, and protest against the recent agreement between the Post Office and the National Telephone Company. This was effected under the guise of an amendment to the address. An inquiry was asked for, further negotiations being suspended until the inquiry was concluded. As a sound supporter of the Government, Sir James Dimsdale was anxious to dissociate the subject from any party bias, and remarked that the "great conference" which deputed him to bring the subject before Parliament was carried on without the slightest suggestion of party feeling. His speech was illustrated by copious extracts from speeches; Mr. Lough seconded the amendment, and had the advantage over the mover, that he was not attacking his own party. Hence, perhaps, a greater freedom in his method of procedure. Upon Mr. Austen Chamberlain fell the duty of defending the Government, and this duty he appears to have carried out well.

Throughout the controversy in the press and on the platform Mr. Hanbury has been the subject of flattering remarks by those who objected to the agreement entered into. What Mr. Hanbury would say or do has been considerably canvassed.

The adherents of the amendment were evidently satisfied that the agreement was quite contrary to Mr. Hanbury's ideas, and we are not sure that some of them did not suggest that his removal to the Board of Agriculture was intended as a special blow to the telephone users of the metropolis. How, then, must their disappointment have been deepened when Mr. Hanbury rose to show how the agreement was in accord with the aims, objects, and recommendations of his Committee. The debate was continued by several honourable members, including the representative of Camberwell (Mr. Banbury), who did not desire that the general taxpayer should provide telephones for the unlimited use of other people, and of the neighbouring Dulwich (Sir J. B. Maple), whose observation that the Government were not likely to get a better chance of buying out the Telephone Company than they had last year, is worth noting. Mr. Burns supported the amendment because he wanted to, and Mr. Bousfield, because apparently his constituents told him to. Sir James Dimsdale was quite willing to withdraw his amendment, but his following would not hear of it. A division was taken, and the amendment lost by 88 votes.

In this matter the House of Commons seems to have shown itself a more business-like body than the conference of local representatives which Sir James Dimsdale called a gathering of business men. The business men did not know the subject, and apparently were unwilling to learn. But the agreement which the Marquis of Londonderry said was unalterable will not be altered, and perhaps the persons

responsible for telephoning London, will now be permitted to go about their business instead of being occupied in defending a position which ought not to have been attacked. Yet the discussion cannot be considered to have been entirely futile. The statements of Lord Londonderry and Mr. Austen Chamberlain will not convince the irreconcilables, but they have served to enlighten many as to the nature of telephone service and its value. As a set-off to the claim for unlimited use for an inadequate payment, the *Standard's* remarks on the debate offer some encouragement:—"Londoners, they say, will not object to paying fairly for a really good article; at present they do not use their telephones as much as they might, not because they are too dear, but because they are too slow and inconvenient."

We believe that the opposition to the Government proposals was not founded on any real grievance, but was largely the result of disappointed expectations, and the expectations were raised by Mr. Hanbury's Committee. That Mr. Hanbury could defend the recent agreement was regarded as almost impossible by the objectors, yet he has had no difficulty in showing that the results secured meet with his approval, and are what were aimed at by his Committee. Wherein lies the difference? We think it will be found in the histrionic phrase, "playing to the gallery." It is a dangerous method to adopt when settlements are to come at later and cooler moments. The public have retained a more vivid remembrance of the froth than of the substance of Mr. Hanbury's proposals. Our comments at the time will serve to indicate the danger which was apparent in those proposals, and our recent articles will have shown how those dangers have been averted by what we cannot but regard as able diplomacy and statesmanlike ability on the part of the Postal officials.

Limit Gauge System.

THE paper recently read before a Glasgow scientific society by Mr. W. H. Booth, is of interest as calling attention to the increasing necessity for all machine shops to improve the accuracy of their production. Machine shops are now being gradually equipped with up-to-date high-class machine tools, and the work turned out from them should be correspondingly more accurate; greater attention will in future be given to systems of gauges and the various methods by which exact work can be more readily secured. Mr. Booth starts by pointing out that with such a comparatively simple piece of work as the turning up of a shaft 1 in. diameter, a good workman working on a high-class lathe may be able to hit off the exact diameter to within ·001 in. This difference may be an increase or a decrease upon the standard 1 in. diameter sought to be obtained. As this shaft has to be run in a bearing, it is evident that a nominal 1 in. bearing must have an extra allowance in diameter, in order to give a free running fit, and this allowance will vary with the nature of the conditions the bearing has to stand. Too small an allowance in the bearing will result in a "keying" fit in which the shaft will run hot, or if too great an allowance is made we shall obtain a loose and shaking fit. Either of these conditions will condemn the work as "bad." At this point we are confronted with the "personal judgment" (determined by trial experiment) as to what constitutes a "working fit." In the absolute gauge system of working hitherto most general in machine shops, a shaft is turned to fit a standard gauge, the gauges being made with the necessary allowance for fit and for lubrication, and the work turned out to them as closely as possible. In this case, as at first mentioned, the fit thus made is really determined by the individual opinion of the workman, and the workman with the greatest skill at his work is in the best position to determine what is the correct fit. Thus accuracy becomes a debatable term. Mr. Booth realises the difficulty of exact accuracy, and points out that there is an allowance of inaccuracy that can be permitted without departure from "good" work. His idea is to select the middle part of the range of possible differences of fits. In this way, templates or standard gauges can be produced which allow a certain average accuracy that can replace the attempt to secure the nearly impossible or absolute accuracy. In the case of a shaft bearing, a double-ended gauge is made so that the small end must enter the bored hole of the bearing as nicely as the skill of the workman will permit, whilst the other end of the gauge must not enter it. This gauge then gives the limits between which the hole must be bored so as to ensure good interchangeable work. A suitable gauge is also made to control the variation that may be allowed in respect to the turned diameter of the shaft. In this way the error caused by depending upon the judgment of the workman is obviated, and the quality of the work he turns out is fixed down to a rigid system, and also allows human fallibility reasonable play. The judgment of the shop inspector does not vary towards the individual workman, who is sure of the acceptance of his work if it will pass the fixed and definite gauge test. Under this method of working, it is necessary for the workman to be supplied with new gauges before those he has in use become spoiled through wear. The workman's skill is developed by leaving him free to obtain the size set by the gauge, whilst putting the smallest amount of labour he can into the job; this attempt forces him to prefer the most accurate and most modern machine tool. Mr. Booth shows illustrations of the various forms of limit gauges in ordinary use. In a composite gauge it is usual to distinguish one limit size from the other, by means of colouring one end, or arranging a difference in shape. A limit gauge system has undoubted uses, and advantages *per se*, to weigh against the objection that the gauges involve expense both in equipment and maintenance. To counteract this, an increase must be made in the general production, that is, for a large production the expenses of gauges can be incurred, where for a limited production their cost might be excessive. Mr. Booth goes closely and clearly into the general details, without attempting to set down the limits or tolerances that can be given in the gauges according to the nature of the machinery being made therefrom, and contents himself with pointing out that the limits depend so much upon the conditions under which the machinery has to work. The paper will, however, have served its purpose if it divides interest and attention in these important requirements of machine shop practice. Mr. Booth incidentally notices a point mentioned by Mr. Bathurst in his articles on "Machine Tools" in our pages, that the boring mill is likely to supersede the lathe for all the most accurate turning work, and that the highest accuracy can be best obtained by the combination of the vertical boring tool with a grinding machine.

Sydney Electrical Engineers' Celebrations. — The tenth anniversary of the Electrical Association of New South Wales was celebrated at Sydney on December 13th by a "trolley-car party and continental." The cars started from the Rushcutter's Bay power house and proceeded to Rose Bay grounds, which were liberally illuminated. During the evening a concert was held and refreshments were dispensed in a marquee.

ENGINES AND BATTERIES FOR POWER STATIONS.

By AN ENGINEER.

II.

The ratio of lengths into which a battery should divide the line brings up the effect of the load factor very prominently, and rather checks the tendency to place the batteries away from the station on large systems. At least this can hardly be done unless one is prepared to instal a total weight of battery considerably in excess of that required when the whole is placed at the station. Thus we may suppose a line of N routes of equal importance. Each of the routes will carry one Nth of the total load, and will have a load factor peculiar to its particular load, and related to the station load factor in the ratio $\frac{1}{\sqrt[3]{N}} : 1$ (*a*).

Generally if the load factor of the whole load be denoted by x per cent., that of the separate individual loads will be

$$\frac{x}{\sqrt[3]{N}} \text{ per cent.} \quad (b).$$

The mass of load to be dealt with by the battery is $100 - x$ (*c*), x being the percentage load factor. Then the surplus of load for each individual line is

$$100 - \frac{x}{\sqrt[3]{N}} \quad (d).$$

As an example, assume the load divided between eight equal feeders. Then we have $N = 8$ and $\sqrt[3]{N} = 2$. The ratio of load factors will be $\frac{1}{2}$ to 1.

The surplus over mean load of the whole station will be $100 - x$, and for the individual lines $100 - \frac{x}{2}$. If we have such a number of cars that the station load factor is 40 per cent., that of each feeder will be 20 per cent.

Then $$100 - x = 60 \text{ and}$$

$$100 - \frac{x}{2} = 80.$$

The battery ratio must thus be increased in the ratio $\frac{4}{3}$ or $33\frac{1}{3}$ per cent. But against this is to be set the fact that the feeder loads do not coincide in their maximum readings, and it might at first appear practicable to allow the various battery sections to discharge backwards through the station into the more heavily loaded lines. This, though possible, would involve too much complication, because it would not be possible for the battery on any section to act automatically in relief of another section.

Obviously, therefore, the conclusion seems inevitable, that only in the case of a single line extending from the power station can a battery be installed other than at the station except at considerably enhanced costs, and this is more particularly so in small than in large systems, because in a small system the load factor improves rapidly with the growth of the system up to a moderate figure, and thereafter but slowly.

There does not seem to be any serious prospect of benefit when batteries are placed at sub-stations except in special cases, unless calculation shows that the greater efficiency of the distribution system, and the smaller cost, combine to justify an additional expense on batteries to the extent of 20 to 30 per cent. The action of a battery at a sub-station is to raise the minimum current in the cables and to reduce the maximum current, so reducing the C^2R losses. The only offset against this would be that of the battery, but as this loss would still be incurred with the battery at the station, it can hardly be counted in this connection. Advocates of the direct current do not seem to have awakened sufficiently to the advantages of accumulators in traction work. Alternate current cannot have the advantages of the accumulator unless transformed to direct current. The system of polyphase motors must thus contend with the great advantages offered by accumulators in respect of the very serious reduction of the station plant, and its more economical working.

The accumulator, in fact, stands as the greatest obstacle in the way of extending polyphase working to small and moderate systems. Mr. Langdon's proposals of a station every few miles could not find loads with a good load factor. Before polyphase working can be a success, it is probable that current must be distributed at very high voltages, so as to cover from one station so great an extent of line as to produce a high load factor. In this way the accumulator will be deprived of its advantages, and direct current will be abolished.

The number of loads on main line railways is so few that it is very improbable that good load factors can be secured, except by means of a large system in parallel working. An examination of a railway map will disclose the fact that from any given centre the maximum mileage that can be brought within the shortest distance of a station at that centre will not necessarily be mileage belonging to the same company. This opens up the railway question in a new light, and properly forms a separate chapter.

PARLIAMENTARY.

The following Bills came on 22nd inst. before the Examiners of the House of Commons for proof of compliance with Standing Orders:—

Piccadilly & City Railway (No. 2).—The Piccadilly & City Railway (No. 2) Bill is brought forward in consequence of the recommendations of the Joint Committee on Tube Railways which considered the Piccadilly Railway (No. 1) Bill last session. The proposals of the promoters last session were to construct a tube railway to commence with an end-on junction with the proposed North-East London Railway at Cannon Street, to go on to Ludgate Circus, Wellington Street, and Charing Cross, and from there either join up with the Brompton & Piccadilly Railway at Piccadilly or with the proposed Hammersmith and Charing Cross line. The Committee considered there should be an end-on junction with the Brompton line at Piccadilly Circus or else a through line from Charing Cross to Hammersmith. In the Bill now proposed power is asked to construct an underground railway from Adelaide Street, Strand, to the Broadway, Hammersmith. The Bill was ordered to be reported for first reading.

North-East London Railway (No. 2).—This is another Bill brought forward in consequence of the recommendation of the Joint Committee on Tube Railways which last session considered the No. 1 Bill of the North-East London Railway. The proposal in No. 1 Bill was to construct a tube railway from Bishopsgate Street to Tottenham, with a branch to Chingford. The Joint Committee thought it desirable that the line should be extended further north, and the new Bill asks for power to extend the suggested line to Southgate on the north and to Fleet Street on the west. The northern extension will enable the railway to serve the large workmen's colony which the London County Council are establishing at Tottenham, while the western extension is a deviation of the original route, so as to obviate the danger of disturbing the subsoil in the neighbourhood of St. Paul's Cathedral. Standing Orders were found to have been complied with.

Kent Electric Power.—By this Bill the Kent Electric Power Company will be incorporated, with a capital of £750,000, for the purpose of erecting and working generating stations for the supply of electric power. The first directors will be Messrs. F. Faithful Begg, T. Newcomen, Archibald Grove, H. Jasper, A. Thorne, and A. Woolley Hart. The area of supply is the county of Kent. A clause gives power of easements over Rochester Bridge. Clause 43 protects the Gillingham Urban Council, and places them in the position of being authorised distributors if their Board of Trade order is confirmed by Act of Parliament within three months of the passing of this Act. The company is required to furnish a supply of energy to authorised undertakers at a price not exceeding those in schedule affixed to the Bill. The company is authorised to enter into agreements with the Chatham, Rochester and District Electric Lighting Company for the transfer of the property, power, &c., of the latter company or any part thereof which may not be transferred to the Gillingham Urban District Council. Power is given to take lands in the rural district of Strood, the rural district of Bleam, the rural district of Dover, and the rural district of Tonbridge for the erection of generating stations. The scheduled prices to be charged are as follows:—Where the company charges any authorised undertaker by the actual amount of energy supplied to them the charge the company shall be entitled to make is (*a*) for any quantity not exceeding the equivalent of 400 hours of supply at the maximum of power which has been demanded by such undertakers, 4d. per unit; (*b*) for any further quantity exceeding the equivalent of 400 hours of supply at the maximum power at 3d. per unit. Standing Orders were found to be complied with, and the Bill ordered to go forward for first reading.

London County Council (Electric Supply).—A Bill to make further provisions with respect to the purchase of electric light under-

takings in the administrative county of London by the local authorities and the L.C.C., and with respect to the supply of energy for stations of the L.C.C. The Bill provides that where a company has power to establish a generating station and supply electrical energy generated at such station to one area only, then the generating station and lands of such company without as well as within the county, shall be subject to purchase as if the same were an undertaking under the electric lighting Acts of 1882 and 1889, and the power of purchase may be exercised by either the local authority or the Council with the consent of the local authority. If the authorised undertakers supply in more than one district, the power of purchase may be exercised by the local authorities of such districts or by a majority of them acting in combination or by the Council. Sec. 4 gives the local authorities power to combine, but not unless authorised by proper resolution. Power is asked for the L.C.C. to carry on undertakings and to supply electrical energy to any local authority being authorised undertakers in a district. All profits shall be divisible amongst the local authorities constituting the purchasing body in the proportions in which they shall have contributed to the purchase of the undertaking. The affairs of a purchasing body shall be controlled by a Joint Committee of persons elected by the constituent local authorities. Standing Orders were complied with.

London United Electric Railways.—A Bill to incorporate the London United Electric Railways Company and to empower them to construct underground railways from Shepherd's Bush to Hammersmith, to Barnes, Charing Cross, Clapham Junction, and the Marble Arch, and for authorising agreements between the company and the London United Tramway Company and others. To acquire certain lands in Fulham and St. George's for generating stations. The estimated cost of the railways is £1,413,047. A memorial alleging proof of non-compliance with Standing Orders had been deposited by Mr. R. J. Walker, but no appearance was made before the Examiner, and the necessary proofs of compliance having been given by the Parliamentary agents, Messrs. Holmes & Co., the Bill was ordered to forward for the first reading.

Derbyshire and Nottinghamshire Electric Power.—The Derbyshire and Nottinghamshire Electric Power Company seek by this Bill to amend their Act of 1901 in some particulars. They wish to repeal so much of Sec. 30 of the Act of 1901 as prohibits the construction of stations for generating electricity elsewhere than on lands described in the schedule. The necessary proofs of compliance with Standing Orders were given.

Devonport Corporation Bill.—The Corporation of Devonport seek powers in this Bill with respect to the construction and working of tramways in the borough. The two new tramways to be constructed within the borough are one of over a mile in length, and a short section of 8·36 chains. Power is asked for running powers over certain portions of the tramways authorised by the Devonport and District Tramways Act of 1898. The Bill was ordered to proceed.

Leicestershire and Warwickshire Electric Power.—Under this Bill the Leicestershire and Warwickshire Electric Power Company is incorporated, with a capital of £750,000. The area of supply includes the following unions:—Stratford-on-Avon, Rugby, Warwick, Coventry, Foleshill, Lutterworth, Nuneaton, Artherstone, Aston (except so much as is in the County Borough of Birmingham), Hinckley, Market Harborough, Uppingham, Billesdon, Ashby-de-la-Zouch, and Melton Mowbray. The power of the company for the supply of electrical energy is subject to the following restrictions: (1) Only to authorised undertakers, or to persons requiring a supply of power. The company shall not supply energy for lighting purposes except to authorised undertakers, provided that the energy supplied to any person for power may be used by such person for lighting any premises or any part of which the power is utilised. The company shall not supply energy (except to authorised undertakers) in any area which at the date of the passing of this Act forms part of the area of supply of any authorised distributors without the consent of such distributors, which consent shall not be unreasonably withheld. Land is scheduled for the erection of power stations in the following places:—Cathiron Spinneys, 9½ acres; rural district of Warwick, 10 acres; Whiteacre, 14¾ acres; Hinckley, 10½ acres; Glenfield, 15¼ acres; Measham, 11 acres. Standing Orders were found to be complied with.

Hastings Tramways.—This is a Bill to empower the Hastings Tramways Company to construct an extension tramway along the sea front between St. Leonard's and the Memorial, Hastings, and to work the same by electric energy. The length of the proposed tramway is 1 mile 6 furlongs 7 chains in length. Power is given to raise additional capital of £60,000. The examination of the Bill was postponed till February 10th.

East London, City, and Peckham Railway.—There was no appearance before the Examiner when this Bill came on, and it was accordingly marked "dead." The proposal in the Bill was to construct an electrically-worked tube railway from Plaistow to Gracechurch Street, and thence to Peckham.

Northumberland Electric Power.—Under this Bill the Northumberland Electric Power Company is incorporated, and powers are conferred upon it to supply electricity in bulk. The incorporators and first shareholders are Messrs. Hugh Andrews, W. M. Angus, Henry Cleveland, John Dent, Thos. Emerson Forster, Frederick Milburn, and D. Milburn, and Sir Thomas Richardson. The company's capital is to be £500,000 in shares of £10 each, with borrowing power to the extent of one-third of that sum. The first directors are to be Messrs. Hugh Andrews, Henry Cleveland, John Dent, John Davison Milburn, Sir T. Richardson, and two other duly-qualified persons. The area of supply includes the bulk of the districts of the Castle Ward Union, the Tynemouth Union, the Morpeth Union, and the Alnwick Union. Standing Orders were found to be complied with.

Garston and District Tramways and Electric Supply Companies.—The object of this Bill is to confirm an agreement between the Garston and District Tramways Company, the Garston and District Electric Supply Company, and the City of Liverpool, for the transfer to the Corporation of Liverpool of the respective undertakings of these companies. The District of Garston has lately been incorporated with the City of Liverpool.—The necessary proofs of compliance with Standing Orders were forthcoming.

South Shields Corporation.—It was the intention of the Corporation of South Shields by this Bill to have acquired power to purchase the tramway undertaking in the town at a cost of £261,562, and also to have greatly extended the service by constructing a number of new lines.—On the Bill coming before the Examiner, however, it was marked "dead."

Great Northern Railway (No. 2).—To empower the Great Northern Railway Company to construct an underground railway in Islington, and to lease the same to the Great Northern and City Railway Company. Power is taken to make a railway 7 furlongs 2·64 chains long, commencing underground at a point 22 yards west of the centre of the main line of the Great Northern Railway and terminating by a junction with the railway No. 3 already authorised. The company may apply their funds towards the purposes of the Act, and may raise additional capital not exceeding in the whole £325,000.—The Bill was ordered to proceed.

Wigan Corporation.—Amongst the things sought to be conferred on the Corporation of Wigan under this Act are powers with regard to the acquisition and construction of tramways. The estimates contained in the Bill allocate £55,570 for altering and adapting the tramways purchased from the tramway company, to work the same by electric traction, and the provision of new rolling stock; and £28,000 for the construction of tramways authorised by the Act; a clause provides that electric fittings hired from the Corporation shall be exempt from distress.—The Bill was ordered to go for first reading.

Romford Urban District Council Tramways.—There being no appearance to prove compliance with the Standing Orders this Bill was marked "dead." The object of the Bill was to empower the Council to construct and work tramways and confer further powers with regard to the electric light undertaking. The intention was to have constructed a tramway which should have joined up with the tramways of the Ilford Urban District Council and have terminated in Romford High Street.

Tipton Urban District Council.—This is an omnibus Bill which gives the Urban District Council, in the County of Stafford, power with regard to tramways. In the estimates prepared for the purpose of the Bill, £80,000 is allocated for tramway purposes. Part 3 of the Bill dealing with electricity gives the local authority, who are now the undertakers for supplying electrical power and energy within the district, power to supply electricity for tramway purposes. Authority is also given to supply electrical fittings and to alter the date for filling up the accounts for electric lighting. Standing Orders were found to have been complied with.

Salford Corporation.—The Salford Corporation's Bill is to enable the Corporation to construct additional tramways, to make street improvements, &c., and to provide for a board for working the tramways in Salford, Manchester and the adjacent districts. The Manchester Corporation in its Bill merely seeks running powers over or power to purchase certain portions of the Salford tramways system. The Salford plan is entirely different. In the preamble the Corporation recites that there is now no through communication by means of tramways between Manchester and Salford, and that it would be much more convenient to the public if there were such communication; and then the Bill goes on to show how the tramways dispute with the Manchester Corporation can be settled. The Bill is divided into eight parts. Standing Orders were found to have been complied with.

Birkenhead Corporation Bill.—Clause 13 of the Omnibus Bill of the Birkenhead Corporation asks for power to supply electrical energy in bulk in neighbouring districts, and also to supply electrical fittings, &c., to consumers. There was opposition to the Bill, but not on the electrical clause, and as far as they were concerned, Standing Orders were found to have been complied with.

Erdington Tramways.—This is a Bill to empower the Urban District Council of Erdington, in the County of Warwick, to construct and make tramways. In the estimates given in the Bill, £52,500 is allowed for land and the construction of tramways, and £50,498 for tramway purposes. The principal tramway is No. 1, which is 2 miles 2 furlongs 9·20 chains long, and it starts at the boundary of the Urban District of Aston Manor, where it joins the district of Sutton Coldfield. The Council can work the tramways themselves, or enter into a working agreement. Standing Orders were found to have been complied with.

London United Tramways.—In this Bill the London United Tramways Company are asking for power to construct further extensions of their tramway system in the counties of London, Middlesex, and Surrey, which will cost £816,053. Memorials were presented against the Bill by the London County Council, the Corporation of Richmond, the Urban District Council of Barnes, the Urban District Council of Wimbledon, the Croydon Rural District Council, and the Chelsea Water Works. It was decided to postpone the examination till February 10th.

Manchester Corporation Tramways.—Authority is given under the Manchester Corporation Tramways Bill for the Corporation to construct additional tramways in the city, to purchase a short length of tramway beyond the city, and to confer running powers over certain other tramways in and beyond the city, &c. The power to purchase is sought in connection with a tramway constructed under the powers of the Manchester Suburban Tramways Act, 1878, 1 furlong 4 chains 7 yards in length, in the Borough of Salford, commencing in Bury Old Road, at the Manchester City boundary, and terminating near the gate of Wilton Polygon. The Corporation also

seek running powers over the Salford tramways in Bury New Road between the Manchester City boundary, near the Grove Inn, and the boundary between the County Borough of Salford and the Urban District of Prestwich. Power is also taken to construct and maintain all works necessary for effecting a junction between the Manchester Corporation tramways in Bury New Road and those of the Salford Corporation. The Salford Corporation is to supply the electricity required as motive power for the tramways running over its own lines, and the terms, if not agreed upon between the two corporations, shall be submitted to arbitration. One of the provisions inserted in the Bill is that: "The Salford Corporation shall not exercise their rights as owners of the tramways in the borough in such a manner as to interfere with or impede the Manchester Corporation in the reasonable exercise of their powers under this Bill." In case of failure on the part of the Salford Corporation to supply the electrical energy required for properly working the tramways over which running powers are sought, or in the event of the Corporation not maintaining the permanent way in a satisfactory manner, the Manchester Corporation takes power to provide its own electricity, and to maintain the lines itself. The last operative section is a very comprehensive one, and gives the Manchester Corporation power "to enter into and carry into effect contracts and agreements with the Salford Corporation and the tramways company, or either of them, with respect to the purchase, sale, lease, reconstruction, alteration, equipment, working, management, and maintenance by the contracting parties, or any of them, of all, or any, of their respective tramways and works, or any part, or parts thereon, the supply of plant, machinery, and electrical energy or power, the conveyance and interchange of traffic and other facilities, and the payment, collection, division, and apportionment of tolls, rents, and charges arising from such tramways and traffic." Standing Orders were found to have been complied with.

Abertillery Urban District Council Bill.—Amongst the powers asked in this Bill is power for the Abertillery Urban District Council to make further provision with regard to the supply of electricity. Last session the Urban District Council was empowered to supply electricity. The estimate of the amount required for the purpose of the undertaking is £50,500. The necessary proofs of compliance with Standing Orders were given.

City and Brixton Railway.—A Bill to authorise City and Brixton Railway Company to abandon portions of their authorised undertaking, and to extend the time for the compulsory purchase of land, and for other purposes. With regard to the extension of time for the purchase of land, this is extended till 1900. Power is given to enter into agreement with the City and South London Railway Company to lease the undertaking. The examination was postponed till February 3rd.

Scarborough Tramways.—Power is asked under this Bill to incorporate a tramway company, and to empower such company to make and maintain certain tramways in the Borough of Scarborough. The capital of the company is to be £96,000 in 9,600 shares of £10 each. The Corporation may at any time, and from time to time subscribe any sum or sums not exceeding in the whole £10,000 towards the undertaking. The company may borrow not more than one-third of the paid up. The Corporation may lend money to the company on the security of the undertaking, providing that the amount of the loan, together with the shares held by the Corporation shall not exceed £10,000. The Corporation may appoint a director. Power is given to acquire land for a generating station, and the Corporation may acquire the undertaking at certain stated periods, the first of which is November 1st, 1915. A memorial was presented against the Bill by the Corporation of Scarborough, and the examination was held over till February 3rd.

National Telephone Company (Manchester Area).—This is a Bill to confer powers on the National Telephone Company within the Manchester area. The operative portions of the Bill are Secs. 4 and 5, which provide that, if any local authority in the Manchester area, having power under the Telegraph Acts to give or withhold consent to the exercise of powers and the erection, &c., of plant for the purpose of public telephonic communication gives any consent to "the Board," then similar consent shall be given to the company if required, and all powers, rights, privileges, &c., granted to the Board shall be taken to apply to the telephone company in so far as they shall be necessary to it, to enable it to compete with the Board in the supply of public telephonic communication. The Board referred to in the Bill is the "Manchester District Telephone Board," which is sought to be incorporated by a Bill deposited this session in Parliament. Under this new Bill it is sought to constitute a board consisting of representatives of the Corporations of Manchester, Stockport and Eccles, which shall have power to provide a system of public telephonic communication. Standing Orders were found to have been complied with.

York Corporation.—The Corporation of York asks for power under this Bill to purchase, construct, and work tramways, &c. The Corporation have entered into an agreement with the York Tramways Company for purchasing the tramway undertaking. In the estimate for the construction of tramways authorised by the Act, and the reconstruction of the existing tramways is £157,000.—The necessary proofs of compliance with Standing Orders were given.

Halifax Corporation.—Under this Omnibus Bill, power is taken by the Corporation to construct 32 sections of tramways. The estimate of the money proposed to be raised is £82,000 for the tramway undertaking, and £17,000 for the purpose of electric equipment in connection with the Corporation tramways. Several clauses deal with the electric light undertaking on which it is proposed to spend £130,000. Land is scheduled for the erection of a generating station. It was decided to postpone the examination of the Bill till February 10th.

Gloucester Electric Power.—A Bill for incorporating and conferring powers on the Gloucestershire Electric Power Company and for other purposes. The company is to be incorporated with a capital of £250,000 to erect and maintain and work generating stations, lay down mains, &c, for energy for power. The first directors are to be Messrs. J. G. Bellamy, J. H. Borrer, T. Newcomen, and Grove, W. J. Paley Marling, J. D. Robertson, A. Thorne and another; power is given to acquire easements and for carrying electric lines over the railway bridge crossing the Severn. The area of supply is the Unions of Stroud, Dursley, Wheatenhurst, Westbury-on-Severn, and so much of the Unions of Monmouth and Tetbury as be within the county of Gloucestershire; the parish or township of Lydney; and the parishes of Aylburton, Alvington, St. Briavels and Hewetsfield in the Chepstow Union; and the parishes of Hill Ham and Stoke, Alkington, Berkeley, Breadstone, Hamfellow and Hinton, in the Union of Thornbury, all in the County of Gloucester. Energy is to be supplied by the company only to authorised undertakers and to persons requiring a supply of power. Power is taken to subscribe for shares or lend money to any company taking, or agreeing to take, a supply of electricity or who are establishing or about to establish factories or works on any of the lands of the company. Land is scheduled for generating stations in the rural districts of Stroud and West Dean. Standing Orders were found to have been complied with.

Huddersfield Corporation.—This is an omnibus Bill. Part 6 deals with electricity and gives the Corporation of Huddersfield power to supply electricity where a consumer is separately supplied, or to refuse to supply electrical energy in certain cases. It also gives the Corporation authority to supply electrical fittings, and that such materials and fittings supplied by the Corporation shall be free from distress. Clause 33 provides that no person shall place any electric line above ground without the consent in writing of the Corporation. The Standing Orders were found to have been complied with.

Tyneside Tramways and Tramroads Company (New Lines and Extensions).—Power is sought to be conferred by this Bill upon the Tyneside Tramways and Tramroads Company for the construction of certain tramways and tramroads. The company was incorporated in 1901 to construct and maintain tramways in the county of Northumberland, and they now ask for authority to construct new tramways and to raise additional capital. In the Bill 10 sections of tramways are described of varying lengths. With regard to purchase by the local authorities, 25 years is substituted for the statutory 21 years. The new capital sought to be raised is £60,000. It was found that Standing Orders had not been complied with, and accordingly the Bill will have to go before the Standing Orders Committee, who will decide whether it shall be allowed to proceed or whether it shall be dropped.

Charing Cross, Euston and Hampstead Railway.—The two Bills of the above company, suspended from last session, came before the Examiner. Bill (No. 1) asked for power to carry out the following works:—(1) To construct a railway 1 mile 3 furlongs 63 chains in length from Hampstead to Golder's Green, this being a continuation of the company's authorised line; (2) a subway under Tottenham Court Road at the Oxford Street end; (3) an alteration of the levels of the authorised line between Haverstock Hill and Hampstead; (4) a deviation of the authorised line in Hampstead Road. It also gives power to acquire land for the erection of a generating station at Hendon. No. 2 Bill asked for power for the company to extend their authorised railways to Highgate and Victoria, and to make agreements with various other companies. Four railways are sought to be constructed, viz., (1) 1 mile 1 furlong in length, from St. Pancras to the Archway Road; (2) 1 mile 3·5 chains, from the Archway Road to Hornsey; (3) 5 furlongs and 4 chains in length, from the authorised railway in Westminster to Parliament Square; and (4) 6 furlongs and 6 chains in length, extending the railway to Victoria. With regard to No. 1 Bill, Standing Orders were found to have been complied with; but in the case of No. 2 Bill, non-compliance was found, and the Bill will accordingly have to go before the Standing Orders Committee.

Islington & Euston Railway.—A Bill for incorporating the Islington & Euston Railway Company, and for empowering them to construct an underground railway, &c. This was one of the Bills suspended from last session, having been before the Tube Committee. The railway proposed is 1 mile 5 furlongs long, commencing in Islington, by a junction with the railway of the South London Company, and terminating in the Metropolitan Borough of St. Pancras at a point under Drummond Street. The proposed capital is £420,000, with the usual powers of borrowing. The company may enter into agreement with the South London Railway for the working of the undertaking. The necessary proofs of compliance with Standing Orders were forthcoming.

Charing Cross, Hammersmith & District Electric Railway.—Power is sought in this Bill to incorporate the Charing Cross, Hammersmith & District Electric Railway Company. The Bill is one of the tube railway Bills suspended from last session. Three railways are proposed to be constructed, viz., (1) from Charing Cross to Park Lane, 1 mile 2 furlongs ⅓ chain in length; (2) from Park Lane to Kensington High Street, 1 mile 7 furlongs 7·6 chains long; (3) from Kensington to Rutland Road, Hammersmith, 1 mile 6 furlongs 1·2 chains long. A subway for communication with the Metropolitan District Railway is sought to be constructed at High Street, Kensington. The capital is £2,100,000. Land is scheduled at Little Church Lane, Hammersmith, for a generating station. Standing Orders were found to have been complied with.

The following Bills came before the Examiner of Standing Orders for proof of compliance on 23rd inst.

Manchester and Liverpool Electric Express.—This is a Bill authorising the company to make what is described as "A deviation railway one mile from their existing powers through the borough of

Salford," and it is important in that it carries out the agreement made with the Salford Corporation last year when the Act then passed was at the Committee stage in the House of Commons. The deviation proposed to be made is described as "A deviation railway 1 mile, 4 furlongs and 8·20 chains in length, commencing in the parish of Salford by a junction with the railway authorised by the Act of 1901, at a point in Ordsall Lane, at or near the junction therewith of West Union Street, and terminating in the parish of Pendleton by a junction with the said authorised railway at or near the southern end of Cemetery Road," and in connection with it the company agrees to form three new streets, viz.:—(1) A new street 54 ft. in width between Ordsall Lane and the point where the deviation passes into and under Tatton Street; (2) a new street of the same width as Montford Street between the west end of Rowland Street and the east end of Montford Street; (3) a widening of Tatton Street to the width of 54 ft. east end of Montford Street. The company take power to abandon the construction of the portion of the line already authorised, but rendered unnecessary by the proposed deviation, but owners of property injured will receive compensation for whatever injury was done them.—Standing Orders were found to have been complied with.

City, Wandsworth and Wimbledon Electric Railway.—A Bill for incorporating the City, Wandsworth and Wimbledon Electric Railway Company, and for empowering them to construct underground railways in the counties of London and Surrey. The works to be constructed are No. 1 railway, 5 furlongs 2·40 chains, commencing in Cannon Street, and terminating near Marshalsea Road. No. 2, 1 mile 6 furlongs 4·25 chains, a continuation of No. 1 railway to Goding Street, Lambeth; No. 3, 2 miles 5 furlongs 9·10 chains, continuing No. 2 railway to St. John's Hill, Battersea; No. 4, 1mile 1 furlong 7·10 chains, continuing No. 3 to High Street, Wandsworth; No. 5, 2 miles 7 furlongs 7·90 chains, continuing No. 4 to Wimbledon. Land will be taken in Wandsworth for a generating station. The capital is to be £6,000,000, and the first directors Ernest Schenk, T. A. Meates, Geo. Riley, Herman Gwinner, and one other. There was no attendance, and the Bill was marked "dead."

King's Road Railway, Putney Extension.—This is a Bill for making an extension of the proposed line, for which power was asked in the last session of Parliament, but which, owing to its going before the Joint Committee on tube railways, did not go to the Parliamentary Committee in the usual course, but was suspended till this session. The Joint Committee, in their report, suggested that the line should be extended to Putney, and this is what the company will be empowered to do in the present Bill. The works for which power is asked are as follows:—A railway 1 mile 3 furlongs 0·76 chains in length, commencing in the parish of St. Mary, Putney, at a point at the east corner of the junction of High Street, Putney, and terminating in the parish of Fulham by a junction to the extended railway No. 1 in the King's Road Railway Bill, suspended from last session, at a point in the centre of New King's Road; (2) a subway from No. 1 railway in Buckingham Palace Road to Willin Road; (3) a subway connecting the railway with Victoria Station and the Metropolitan District Railway. The capital of the company will be £1,250,000. The first directors will be Sir Owen Randall Slacke, Sir R. Sankey, Lord Teynham, John MacAllister, and three other persons. Standing Orders were found to be complied with.

Victoria, Kennington and Greenwich Railway—For incorporating the Victoria, Kennington and Greenwich Railway, and empowering them to construct an underground railway in the County of London. The railway is to be worked in conjunction with the West and South London Junction Railway, the Bill for which was suspended from last session. The railway will be 4 miles 5 furlongs and 160 yds. in length, commencing in Lambeth by a junction with the proposed West and South London Railway and terminating in Greenwich. Power is asked to take land in Lambeth for a generating station. The capital of the company will be £3,000,000, and the first directors Mr. Harding Cox, Mr. J. Brandon, Mr. F. Horner, and two others. There was no attendance, and the Bill was marked "dead."

Great Northern and Strand Railway.—A Bill to authorise the alteration and extension of the railways of the Great Northern and Strand Railway Company, and the transfer of their undertaking to the Brompton and Piccadilly Circus Railway Company. The company was incorporated in 1899 and authorised to make an underground railway from Wood Green to the Strand. Authority is now asked to construct (1) a line 2 furlongs 1·21 chains to carry the authorised line to the Temple Station of the District Railway; (2) the deviation railway 4 furlongs 7·40 chains, commencing with a junction with the authorised railway in Islington and terminating at Hornsey. Power is also asked to abandon the construction of railway No. 1 authorised by the Act of 1899, and of so much of the railway No. 2 authorised by that Act as has between its commencement and the commencement of the deviation railway sought to be constructed by this Act. If the amalgamation of the Brompton Railway is carried through, this line will be constructed by the new company. Power is given to enter into agreement with the District Railway Company or the District Traction Company for the supply of electricity. The Bill was ordered to go forward for first reading.

L.C.C. (General Powers Bill).—Amongst the clauses contained in this Bill is one to enable the Camberwell Borough Council to purchase lands for the erection of a generating station and works. The land is in Hill Street. Clause 76 says:—It shall be lawful for the Council of any Metropolitan borough, being authorised to supply, and supplying electric energy, to expend money on wiring and fitting wires, &c., to consumers. Clause 77 says:—Any such Council may borrow money in the same manner, and subject to the same conditions as if such expenditure were for the purposes of the Electric Lighting Acts, 1882, and 1888. Standing Orders were found to have been complied with, and the Bill will go forward for first reading.

Rossendale Valley Tramways.—A Bill to authorise the Rossendale Valley Tramway Company to extend their tramways, and for other purposes. Under this Bill the company ask for authority to construct six new tramways of a total length of over six miles, and to take certain lands for the purpose thereof, amongst which is a site for a generating station in the Borough of Rowdenstall. The company also ask for power to raise additional capital not exceeding, in the whole, £200,000. The examination of the Bill was postponed.

National Telephone Company (Kingston-upon-Hull).—A Bill to make further provisions with reference to the undertaking of the National Telephone Company, Limited, within the City of Kingston-upon-Hull. The Corporation of the borough are applying for a license from the Post Office, and have given the company notice to terminate certain agreements. The company in their Bill seek further powers to place them in the position of being able to compete on an equal footing with the local authority. Standing Orders were found to have been complied with.

West Ham Corporation.—In the Omnibus Bill of the West Ham Corporation an estimate is given for money required for electric lighting purposes, of £25,000, and power is also sought to make a junction line with the tramways of the North Metropolitan Company, for which the estimate is £1,300. It was found that Standing Orders had not been complied with, and the Bill will, accordingly, have to go before the Standing Orders Committee.

L.C.C. (Subways and Tramways).—A Bill to empower the L.C.C. to construct and use the subway and tramway between Theobald's Road and the Victoria Embankment, and to confer further powers on the Council with reference to subways and the laying of tramways therein. The Council are empowered to serve notice on companies using the streets to lay pipes and mains, &c., where subways are constructed. Standing Orders were found to have been complied with.

The following Bills came before the Examiners of the House of Commons on 24th inst. for proof of compliance with Standing Orders:—

Wrexham District Tramways.—A Bill for empowering the Wrexham and District Electric Tramways, Limited, to construct new tramways and other works, and to work the said tramways by electrical power. The company are the owners of the tramways authorised by the Wrexham District Tramways Act, of 1873, and have agreed to purchase the tramways authorised by the Wrexham District Tramways Order, 1899. The tramways to be constructed are in the Parish of Rhosllanerchrugog, in the County of Denbigh, and are: No. 1, 2 furlongs 3·36 chains in length, and No. 2, 2 furlongs 8·23 chains. With regard to the purchase by local authority it is asked that Sec. 43 of the Tramways Act, 1870, shall in its application to the undertaking be modified by the period of 42 years being substituted for the period of 21 years, and that the terms upon which the company may be required to sell the undertaking shall be the terms of paying the fair market value thereof as a going concern, but without any allowance for compulsory purchase. The examination of the measure was postponed till February 10th.

Cavehill and Whitewell Tramways.—Under this Bill it is sought to empower the Cavehill and Whitewell Tramways Company to work their tramways by electricity, to raise additional capital and other purposes, and to use land in the townland of Drumnadrough, in the county of Antrim, for a generating station. The additional capital which the company is authorised to raise is a sum not exceeding £60,000. Standing Orders were found to have been complied with.

City and Crystal Palace Railway.—A Bill for incorporating the City and Crystal Palace Railway Company, and for empowering them to construct an underground railway from Cannon Street to the Crystal Palace, and to take lands in Camberwell for a generating station. The capital is to be £3,750,000, and the first directors Geo. Riley, Herman Gwinner, and Jameson Ritchie. The necessary proofs of compliance with Standing Orders were given.

Brighton and Rottingdean Seashore Electric Tramroad.—This is a Bill to authorise the Brighton and Rottingdean Electric Tramroad Company to divert a portion of their existing and authorised tramroad in the county of Sussex and to construct a new tramroad in lieu thereof. In 1893 the company was authorised to construct a line and raise £20,000 by shares and £5,000 by borrowing. In 1896 an additional £8,000 for shares, and £2,000 for borrowing was authorised. They now asked to make a deviation tramroad 2 miles 2 furlongs and 7 chains in length, to be constructed on an open viaduct, and in substitution for the tramway constructed by the Act of 1893, commencing at the eastern boundary of Brighton, and terminating at the western side of the gap at Rottingdean. They also ask for power to raise £30,000 additional capital, and to borrow £10,000. Standing Orders were found to have been complied with.

Manchester City Circle Railway.—Under this Bill the Manchester City Circle Railway Company ask for power to construct a tube railway. It is only to be 2½ miles in length, which will carry it at no point more than three-quarters of a mile from its commencement at the junction of Todd Street and Long Millgate. The company proposes to take power to use and appropriate without compensation therefor, the subsoil and undersurface of any public street shown on the deposited plans. Sec. 7 describes the method of construction to be adopted. This is to be done by means of steel shields driven into the subsoil by hydraulic pressure, and within these shields the men will excavate, and line the tubes with metal plates of sufficient strength, and where necessary with brickwork in cement. The shafts where necessary are to be sunk as a cylinder of iron, and where there is solid rock, the shaft is to go at least 2 ft. deep into the rock. The station tunnels are not to

exceed 35 ft. in diameter, the tunnels between the stations 12 ft., and the shafts 40 ft. Between the linings of the tunnels or shafts, and the soft subsoil, the interstices are to be filled up with lime or cement placed therein under pressure. For the purpose of keeping water out of the works, compressed air is to be used, and no pumping is to be allowed except in case of accident, or to remove rain water or other trifling amounts of water that percolate into the borings. The fares proposed to be charged are very high compared with those on the most recently-authorised London tube systems, where a uniform fare of 2d. for any distance is all that is asked. In the case of the Manchester City Circle, power is taken to charge a minimum first class fare of 6d., second class 4d., and third class 2d. for distances up to two miles, and every fraction of a mile beyond two miles, or any greater number of miles, shall be deemed a mile, and the charge per mile is 3d. for first class, 2d. for second class, and 1d. for third class. The company's authorised capital is to be £1,200,000 with borrowing powers to the extent of £400,000 more. The incorporators and first directors are Messrs. Henry Fishwick, Frederick John Davis and Frederick Jones. There was no attendance, and presumably, therefore, the Bill is dropped.

Newcastle Electric Supply.—This is a Bill to confer further powers upon the Newcastle-upon-Tyne Electric Supply Company; under Sec. 9 the local authority may object to any proposed route for electric lines on the ground that it would traverse principal thoroughfares or busy streets, and may indicate an alternative route or deviation which, if thought reasonable by the Board of Trade, and if it does not involve undue increase of expenditure, shall be adopted. The company will only be allowed to supply electrical energy to authorised distributors or to other persons requiring a supply for power. In the schedule annexed to the Act, the prices are stated to be 6d. per unit for any quantity not exceeding 90 hours of supply, at the maximum power demanded by the consumer, and 2d. per unit for any further quantity. The dividend paid out of the clear profits of the company must not exceed 8 per cent., unless the average price per unit is less than 2½d., the standard price, in which case the dividend may be increased in the ratio of 4s. per cent. in respect of every 1¼ per cent. by which the average price charged is below the standard price. If the average price charged is above the standard price, the dividend is to be reduced. Sec. 28 gives the company power to enter into agreements with the County of Durham Power Supply Company and the County of Durham Electrical Distribution Company for the supply to them of energy for use beyond the promoters' area of supply. The Bill was ordered to go forward for first reading.

Eastbourne Corporation—This is an Omnibus Bill, and amongst the provisions contained in it are several with regard to the electric lighting undertaking, giving the Corporation power to supply electrical energy to premises having a separate supply. Standing Orders were found to have been complied with.

Nottingham Corporation.—To empower the Corporation of Nottingham to construct additional tramways. Twelve new tramways of varying length are specified in the Bill. Power is asked in respect of the electric lighting undertaking, to alter the dates of making up accounts. The necessary proofs of compliance were given.

North Metropolitan Electric Supply.—A Bill for extending the limits of supply authorised by Parliament; to extend the area of supply to Willesden, and take certain lands in that parish for the erection of a generating station; to raise £250,000 additional capital. The Bill was ordered to go forward for first reading.

North Staffordshire Tramways.—A Bill for empowering the North Staffordshire Tramways Company to work their tramways by electrical power, and for conferring further powers upon that company and the Potteries Electric Traction Company, Limited, with regard to their respective tramways. Power is taken to use certain lands in the Parish of Stoke-on-Trent, and the Parish of Wolstanton for generating stations. As to the future purchase of tramways by local authorities, power shall only be given as follows: As regards a portion of the tramways in the Borough of Longton in 1918; as regards a portion of the trams in Hanley in 1917; as regards portions of tramway in the boroughs of Burslem and Stoke-upon-Trent, and the Urban District of Fenton in 1917.—The Standing Orders were found to have been complied with.

London, Tilbury and Southend Railway.—The Bill promoted by the London, Tilbury and Southend Railway under Clause 28, empowers the company at any time to work any part of the line by electrical power, and to lay down, maintain and use along any of the railways electric cables, mains, wires and apparatus necessary for transmitting electrical energy; or, it may enter into contracts with any other company or person to supply electrical energy for the working of the railways of the company or any part thereof. Power is taken to lease the Whitechapel Branch Railway and the Whitechapel (Mile End) station to the Metropolitan District Railway. The company with the District Company and the Whitechapel Railway may enter into agreement with one another with respect to the use of the latter railway. Powers taken to take and hold lands at Little Ilford for the purpose of a generating station.—The necessary proofs of Standing Orders were given.

Whitechapel and Bow Railway.—This is a Bill to confer further powers on the Whitechapel and Bow Railway Company, and for other purposes. This railway connects the Metropolitan District Railway and the London, Tilbury and Southend Railway. Power is sought to complete the railway as a railway adapted for electric traction, and to equip the same as may be necessary. It shall be lawful for the company and the District Company, and the London and Tilbury, to enter into agreements with any company or Corporation for the supply of electric energy. Running powers are sought over certain portions of the District Railway, and power to make working agreements with the District Railway and the London and Tilbury Railway.—Standing Orders were found to have been complied with.

Norwich Corporation.—Under this Bill, power is asked to carry out the transfer of the electric lighting undertaking from the Norwich Electricity Company to the Corporation of Norwich. The Bill was ordered to go forward.

Ashton-under-Lyne and Dukinfield.—Under this Bill it is proposed to acquire the Alma Bridge, and to abolish the tolls now taken by the owners of the bridge, the Ashton-under-Lyne and Dukinfield Bridge Company. The bridge was built in 1854 under an Act of Parliament of that year, and the two Corporations now propose to acquire it, mainly because of the difficulty of otherwise constructing a satisfactory tramway system through the two towns. There are, however, other important provisions in the measure. One of these confers on the Ashton-under-Lyne Corporation power to lease any tramways or light railways which form junctions with the tramways or light railways owned or leased by the Corporation, and the Corporation also takes power to sell, let for hire, fix, alter, repair, or remove (but not manufacture) electrical appliances. It is also provided that in the Borough of Ashton-under-Lyne no person shall in future act as driver, or have care, of more than one cart or carriage. In the first schedule of the Act, the price fixed for the sale of the Alma Bridge is £8,333 6s. 8d. The Bill will go forward for first reading.

Southport and Lytham Tramways.—A Bill by the Southport and Lytham Tramroad Company, which was formed for the purpose of constructing a tramroad from Southport to the north along the seashore, and then to bridge the estuary of the River Ribble with a conveyor bridge of peculiar construction. The amount of progress actually made with the project is much less than was expected to be made by the promoters when the Bill was originally passed, and now it is sought to increase the length of time during which the work may be completed by three years in the case of the tramroad, and five years in the case of the conveyor bridge. The financial arrangements of the company are also not such as they desire, and so power is taken to divide the shares in two. One part is to be called a deferred half share, and must be fully paid up, while the other half share is to be called a preferred half share, and on this must be paid up at least 20 per cent. of its nominal value. Standing Orders were found to have been complied with.

The following Bills, amongst others, came before the Examiner for proof of compliance with Standing Orders on 27th inst:—

North Metropolitan Tramways.—Under this Bill the North Metropolitan Tramways Company seek powers to convert their tramways within the County of Middlesex for electric traction. The tramways which are within the County of London, worked by the company, are owned by the London County Council, from whom the company hold a lease. Power to convert the tramways is held under the London County Council Act. Standing Orders were found to have been complied with.

Middlesex County Council Tramways.—This is a Bill for empowering the County Council of Middlesex with certain powers under the Tramways Act, 1870. The Council ask that they should be deemed a local authority for certain purposes of the Act. Practically, what the Council seek is the power to construct tramways along the roads, and to control the tramway system of the county. The necessary proofs of compliance with Standing Orders were forthcoming.

South Wales Electrical Power Distribution Company.—The South Wales Power Distribution Company was incorporated by the South Wales Power Distribution Company Act, 1900, and empowered to construct and provide certain electricity generating stations for the storage and supply of electricity within the County of Glamorgan, and part of the County of Monmouth. Under the present Bill the company ask that they may be empowered to acquire further lands as an additional site for a generating station. The land in question is 20½ acres in extent, situated in the Urban District of Llantrannum, in the County of Monmouth. The necessary proofs having been given, the Bill was ordered to go forward for first reading.

Bexhill and Rotherfield Railway.—A Bill for the abandonment of the Bexhill and Rotherfield Railway. The company was empowered in 1891 to make the railway, but none of the powers have been exercised. The examination was postponed till February 3rd.

PROCEDURE OF PRIVATE BILLS.

The Chairman of Ways and Means has reported that he has conferred with the Chairman of Committees of the House of Lords for the purpose of determining in which House of Parliament the respective private Bills should be first considered. It has been decided that the following electrical Bills, or Bills containing electrical clauses, shall originate in the House of Lords:—Ashton and Dukinfield Corporation, Abertillery Urban District Council, Baker Street & Waterloo Railway, Birmingham and Midland Tramways, Bradford Corporation, Brompton & Piccadilly Railway, Central London Railway, Charing Cross, Euston & Hampstead Railway (No. 3), Charing Cross, Hammersmith & District Electric Railway, City & Crystal Palace Railway, City & North-East Suburban Electric Railway (No. 2), Devonport Corporation, Donegal Railway, Edgware & Hampstead Railway, Exeter and District Tramways, Great Northern & City Railway, Great Northern & Strand Railway, Great Northern Railway (No. 2), Hastings Tramways, King's Road Railway (Putney Extension), Leicester Corporation, London & Brighton Electric Railway, London United Electric Railways, Manchester District Telephone Board, Mexborough & Swinton Tramways, National Telephone Company (Manchester Area), National Telephone Com-

pany (Kingston-upon-Hull), Newcastle-on-Tyne Corporation, Tramways, North and South Shields Electric Railway, North-East London Railway (No. 2), North Ormsby, South Bank and Grangetown Tramways, North Staffordshire Tramways, Northumberland Electric Tramways, Nottingham Corporation, Piccadilly and City Railway (No. 2), Rhondda Urban District Council, Rossendale Valley Tramways, Saddleworth, Springhead and Lees Tramways, South Shields, Sunderland and District Tramways, Torquay and Paignton Tramways, Tyneside Tramways and Tramroads, Wigan Corporation, and Wrexham Tramways. The tube railways suspended from last session will also originate in the House of Lords.

LEGAL.

LANE *v.* ELLIOT BROS.

THIS case came before the Master of the Rolls and Lord Justices Romer and Mathew in the Court of Appeal on Wednesday last week on the appeal of the defendants from the judgment of Mr. Justice Ridley, sitting without a jury in the King's Bench Division in January of last year. This was an interpleader issue. The plaintiff, a chartered accountant, of Birmingham, sued, as Receiver of the New Fowler-Lancaster, Limited, a Birmingham company, to recover £269, which was alleged to be due from the Corporation of Brighton for certain electrical work performed for them under contract. The defendants, a firm of electrical engineers, carried out the work of the Birmingham company, and obtained from Mr. Justice Buckley a garnishee order for the balance of an account due from the Brighton Corporation. The issue sent to the Court for trial was, whether the plaintiff, as a Receiver for the debenture holders of the New Fowler-Lancaster, Limited, was entitled to the money, or whether the defendant firm, who carried out the electrical work, had prior claim. It seemed that the original company was incorporated in Birmingham in 1894 under the style of the Fowler-Lancaster, Limited, and was reconstructed in 1897 under the name of the New Fowler-Lancaster, Limited, and in August of that year debentures to the amount of £12,000 were issued by the new company. In January, 1898, the name of the company was further altered by dropping the word "New," and that was approved by an extraordinary general meeting in February, and formally approved at another meeting in March. Although the alteration in name was duly registered at Somerset House, the secretary omitted to apply for the sanction of the Board of Trade under the Companies' Acts, and therefore the new name of Fowler-Lancaster, Limited, was not a legal name. The company, however, continued to carry on its business under the amended title, and among other contracts entered into was that with the Brighton Corporation. On these facts the plaintiffs' contention was that there being no such company as Fowler-Lancaster, Limited, the contract, though purporting to be entered into with the company, was really entered into with the New Fowler-Lancaster, Limited, which was the only company legally in existence at the time. In that case the debenture holders of that company had prior claim to the property of the company, and plaintiff, as receiver on their behalf, was entitled to judgment. The defendants contended that because the company's real name was New Fowler-Lancaster, Limited, and that the debenture holders' rights, whatever they were, were in respect of that company, they could have no rights as against Messrs. Elliott Bros., to receive this money, because the defendants had contracted not with the New Fowler-Lancaster, Limited, but with Fowler-Lancaster, Limited, which company had no debentures. Mr. Justice Ridley held that the debenture holders had a right to take this money, and therefore entered judgment for the plaintiffs on the issue. Hence the present appeal of the defendants.

Mr. Dankwerts, K.C., and Mr. Lowness, appeared for appellants; and Mr. Lawrence, K.C., and Mr. McIntyre, for the respondents.

The MASTER OF THE ROLLS, without calling upon counsel for the respondents, dismissed the appeal with costs. He said the first point taken by the appellants was that they beg the garnishee order. Having obtained absolute right to the money in question, the Brighton Corporation had no authority to make the plaintiff and defendants interplead in respect of the sum owing. Had that point been taken in the first instance the defendants would probably have succeeded, but they waited to see what the result of the interpleader proceedings would be before they raised the question. That was too late, and it could not now be raised. The only question for the Court, therefore, was with regard to the interpleader proceedings. The conclusion to which he had come was that, in the circumstances of the case, and inasmuch as the parties were claiming through the same company, Mr. Justice Ridley was right in entering judgment for the plaintiff, who, as receiver for the debenture holders, had prior claim to the assets of the company.

Lords Justices Romer and Mathew concurred.

PATENT EXPLOITATION, LIMITED, *v.* SIEMENS BROS. & CO., LIMITED.

THIS case came before Mr. Justice Buckley in the Chancery Division of the High Court of Justice on 21st inst., and continued over several days, judgment being reserved. The action was brought by the Patent Exploitation, Limited, Lord Street, Liverpool, for an injunction to restrain the defendants from infringing the letters patent No. 1,110 of 1890. An alternative claim was made for damages.

Mr. Cripps, K.C., Mr. Astbury, K.C., and Mr. A. B. Shaw appeared for the plaintiffs, and Mr. Moulton, K.C., Mr. Walter and Mr. Hume represented defendants.

It appeared from the statement of claim that the plaintiffs maintained they were the registered legal owners of the letters patent in question. It was granted to Charles Addison Hitchcock for a new invention entitled "an improvement in galvanic batteries." The particulars of breaches set forth that the defendants had infringed the patent by manufacturing at their works at Woolwich shortly before the month of December, 1900, and by the sale in that month to different persons of batteries and of cells made in the manner described and claimed in the complete specifications of the plaintiffs' letters patent. The defendants denied that the plaintiffs were at the date of the writ the registered legal owners of the patent, or that they had any title tothe same. They also denied that they had infringed the letters patent, and alleged that the patent was invalid by reason of the matters in the particulars of objection. The particulars of objection set out that the alleged invention was not new by reason of (*a*) a prior publication of the invention; (*b*) prior user of the invention; and (*c*) prior public knowledge. The particulars further alleged that the invention had been published in this country prior to the date of the said letters patent by the following specifications:—British—(1) Winter, No. 2,637 of 1874; (2) Newton, No. 4,739 of 1880; (3) Walker, No. 833 of 1833; (4) Webb & Jensen, No. 1,998 of 1883; (5) Abel, No. 1,929 of 1887; (6) Dymond, No. 17,238 of 1888; (7) Dymond, No. 18,754 of 1888; (8) Smith, No. 2,297 of 1889; (9) Arnold & Coryell, No. 9,153 of 1889. French—Thiebaut, No. 142,524 of April 26th, 1881, and the additions made thereto dated August 16th, 1881, and April 3rd, 1882. German—Bender, No. 48,695, dated December 9th, 1888. American—Roberts, No. 386,090 of 1888. The particulars of objection went on to state that the invention had been published in certain passages of Prof. Silvanus Thompson's book "Elementary Lessons in Electricity and Magnetism," issued in 1882; and in Delahaye's "L'Année Electrique, Deuxième Année," which was published in France in 1886. The particulars further represented that the invention had been used in this realm prior to the date of the letters patent by the defendants who purchased in 1889, and used in the same year at their works at Woolwich Gassner dry cells, which cells were constructed substantially as described in the plaintiffs' letters patent; by the importation by Messrs. Kemp & Lauritzen, of Copenhagen, in February, 1888, and the use by Messrs. Johnson & Phillips, by the India-Rubber, Gutta-Percha and Telegraph Works Company, and by Messrs. Woodhouse & Rawson, within this realm, of dry cells known as "Hellesen dry cells," which cells were constructed substantially as described in the plaintiffs' specification. The particulars went on to allege that there had been prior user of the invention by the common general use of sawdust, plaster, and other suitable materials for fixing the liquids used in galvanic batteries, and by the common general use of a depolarising agent in mixture with the exciting agent in contact with the negative electrode. The defendants further pleaded that the alleged invention was not proper subject matter of letters patent.

Mr. CRIPPS, K.C., in opening the case for the plaintiffs, said they had been advised that there was no anticipation, and nothing to constitute absence of subject matter. He did not imagine that the point as to infringement would be a very serious point in the case if the plaintiffs were right as regarded the validity of the patent. The subject matter of the invention was what was known as a dry cell or dry galvanic battery. There was no question as to the principles involved in galvanic batteries. These were very old. The subject matter of the invention was the particular way of applying what were well-known principles in a manner that had never been invented or arrived at before. That was a novelty in this particular patent. The real problem was—and there had been a very large number of attempts to solve it in a very effective manner—to apply the exciting and depolarising agents in such a manner as to get the maximum efficiency, and enable the cell to have as long a life as possible. As regarded the utility of the patent in question there could be no doubt. The cells were sold by hundreds of thousands, and they had driven everything else out of the market. During the last year or two, whilst what was alleged by plaintiffs as an infringing cell was offered for sale, the number of cells manufactured by plaintiffs was to a certain extent affected. Proceeding, the learned counsel described the type of cell in the invention. The outside case was zinc. Inside, and next to the zinc, there was the exciting agent, which, instead of being liquid, was of a plastic or semi-plastic character. It was essential that it should not be liquid, and it was essential that it should be a material that would stand in its place, and that it should be a material sufficiently damp, not only for the purpose of conducting the electricity, but in order that it should remain against the zinc. There were various attempts to make a cell of that description, but some of them failed owing to the fact that the material used in connection with the zinc dried up, and was no longer in close contact, with the result that the cell became practically valueless. The inner part of the cell was carbon, and between the carbon rod and the plastic material was a black mixture, which contained both the depolarising and the exciting agent. It was so constituted that the depolarising element could never diffuse through the plastic material. If it did so, it might attack the zinc when the cell was not in action, and that would be a waste and a disadvantage. The depolarising agents were pulverised peroxide of manganese 3 parts, with pulverised carbon 3½ parts. Prior to the date of this specification, there was no instance where a powdered material was used in the same way as in the invention in question, and there was no prior knowledge before the date of Hitchcock's patent of 1890. The learned counsel then produced a cell, which he declared was an infringement of the

plaintiffs' patent. He considered that the cell produced was an exact copy of the patent in question. Hitchcock's claim was, "A galvanic battery, having the space between its positive and negative electrodes filled with a semi-solid or plastic exciting agent in two layers, the one layer in contact with the negative electrode having depolarising agents intermixed therewith, and the other layer in contact with the positive electrode having no such depolarising agents, substantially as set forth."

Prof. SILVANUS THOMPSON was then called in support of the plaintiffs' case. He stated, in answer to questions by Mr. Cripps, that it had always been one of the objects of inventors to get rid of local action in such cells. The witness stated that there was no scientific difficulty in the construction of the plaintiffs' specification. It was exceptionally clear. They began with what was called the exciting agent. Details were given as to the preparation of the mixture. In order to get an efficient cell of long life it was important to get this moist paste-like substance. There must be a sufficient supply of moisture to last. The next mixture was the depolarising mixture—the second layer. This mixture was such that it was not diffused through the exciting mixture. There was value in having the exciting agent mixed with the polarising agent—it reduced the resistance. It had been found very useful commercially.

Mr. CRIPPS: Speaking generally, do you know of any other cell—dry cell—which has the same efficiency and life?—I know of none.

Do you know of any dry cell of similar directions and arrangements?—No; I know of none.

His LORDSHIP: Before 1890, you did not know of the existence of any other cell or cells?—No.

Examination continued: He thought there was an advantage in having the powdered carbon mixed with the powdered peroxide of manganese. This problem had been intended to be solved by a good many inventions. He had looked through all the suggested anticipations with regard to the question of subject matter. He liked to have examples of these inventions as they came out. He did not find anywhere in any of the alleged anticipations the structure and arrangements which were disclosed in the plaintiffs' specification.

Cross-examined by Mr. FLETCHER MOULTON: Just look at line 26. "The materials mentioned as electrodes"—which means zinc and carbon—"and as exciting and depolarising agents, and their proportions may be varied." That applies to any batteries, whatever the electrodes were?—There are limits within which you may vary; you cannot use, say, mahogany.

That is not an electrode. Will you tell me anything in the specification which limits the choice of electrodes?—I think that common sense would tell you.

Perhaps you draw a distinction between common sense and electrical knowledge. He says it may apply to any electrodes, and you do not get out of my patent by using any electrodes?—It does not draw a specific line.

Does it give any dividing line?—It assumes that there are materials which may be used as possible electrodes.

I put it to you that any electrode may be used?—Any ordinary electrode.

You may vary the electrodes and vary the substances used for exciting and depolarising agents. I put it to you that it is not a particular battery that his invention dealt with, but it was batteries generally—a particular transformation of batteries generally?—I do not think it would be so understood.

I put it to you that he meant to claim it for any kind of battery?—The specification obviously relates to a type of cell.

The WITNESS, further cross-examined, said that the claim must be read in connection with the body of the specification. As he understood the specification, it related to a type of cell like the Leclanché, viz., a non-acid excitant and a solid depolariser. He stated that chloride of zinc was a very well known hygroscopic agent, with a reputation quite equal to its merits.

Mr. MOULTON: Now let us see what light the specification throws on the particular adjective used. Would you look at line 23: "These are mixed with water two parts to form a semi-solid, which is packed in around the carbon C." Do you see that?—Yes.

The substances are pulverised peroxide of manganese, which is an insoluble powder like very fine sand?—Yes.

And pulverised carbon?—Yes.

So that it really consists simply of a powder moistened as far as its physical condition is considered?—With sal ammoniac and chloride of zinc.

The learned counsel then referred the witness to a certificate relating to a battery described in a French patent, No. 142,524, of April 26th, 1881. In that battery there was a stick of carbon, and that which was around it was a mixture of potash, plaster of Paris, and peroxide of maganese.

Mr. MOULTON: He there admits the excitant and the depolariser, and he uses them thus?—It is altogether an impracticable thing.

Referring to "Castle Smith," the WITNESS stated that in that patent a hole was put so that the gas could get out. He did not suppose that Castle Smith thought it to be new, because he did not claim it. It had been in every Leclanché cell from the beginning. The Castle cell under that name was not largely sold in the market. He knew the Hellesen cell. It was one of the first dry cells in the market, and had at one time a considerable sale, but it was one of those that had now been superseded. Castle Smith's specification described a great deal more than any one cell. It described a method of solidifying the electrolyte for secondary batteries—accumulators. The Hellesen cell differed in several ways from Castle Smith's specification. The outer liquid was not a sticky stuff. The carbon in the Hellesen cell was made hollow with a lot of asbestos stuffed up the interior. Oxides were used in the Hellesen cell.

Mr. MOULTON, in answer to his LORDSHIP, said that the Hellesen cell was the commercial name for the Castle Smith.

Re-examined by Mr. CRIPPS, the WITNESS stated that it was extremely important to keep the depolarising agent away from the zinc, and so far as he knew, the plaintiffs' system was the first attempt at doing it in that way. It was the first time that they had got the non-diffusion without any diaphragm or canvas bag. That was very important, because the diaphragm interfered with the conductivity.

Assuming that our patent is valid, in your opinion is what the defendants did an infringement?—Is not that for the Court?—I take it that the construction and purpose are identical.

The hearing was adjourned.

The hearing of the case was resumed on 22nd inst.

Mr. JOHN REGINALD GAUL, in answer to Mr. SHAW, said he was employed in the Engineers' Department of the National Telephone Co. He had had 15 years' experience as electrical engineer, and was very well acquainted with all types of battery. The Telephone Company now largely used the E.C.C., or Burnley, type of battery, which was the plaintiffs'. Up to the date of plaintiffs' invention, the Telephone Company had used no other type of dry cell battery except experimentally. The Burnley battery was a successful one commercially. The company began to use it in 1892, and since that time they had bought considerably over 120,000. The Obach cell of the defendants, as far as efficiency was concerned, was equally as good as the plaintiffs' cell. The company commenced to buy the Obach cell about four or five years ago. With the exception of these two batteries, the company had not found any dry batteries successful.

Cross-examined by Mr. WALTER: He could not speak as to the relative construction of the different batteries. He could only speak as to their efficiency. A dry battery with no vent-hole at the top would probably burst. The company did have some trouble with the early cells supplied by plaintiffs. Some of the cells had burst, but that happened with all dry cells.

Prof. JOHN ATTFIELD, examined by Mr. ASTBURY, said he was a Fellow of the Royal Society, a Fellow of a considerable number of other scientific bodies, author of a manual of chemistry which had run to its 17th edition, and Professor of Chemistry to the Pharmaceutical Society for 34 years. He had examined all the documents that were alleged as anticipating plaintiffs' invention. He did not find the plaintiffs' invention, or any of its characteristics, disclosed in any of these earlier documents. Nothing in them would lead him as a chemist to make a battery having the characteristics of plaintiffs' battery. In the plaintiffs' specification, he found a clear direction for keeping away the depolariser from the zinc. The construction of a battery, according to plaintiffs' specifications, gave advantages which could not be found in any of the alleged anticipations. The plaintiffs' battery had superseded all attempted dry batteries before it. The improvements in its construction sufficiently accounted for that fact. He had been given one of the defendants' Obach batteries to analyse. From that analysis he had no hesitation in saying that that battery was made in accordance with the plaintiffs' specification.

Cross-examined by Mr. WALTER, WITNESS said he did not pretend to be an electrical expert. No specific electrodes had anything to do with plaintiffs' invention. He was not familiar with the Daniell cell. The specification of the plaintiffs was not limited in his opinion to plaster of Paris and nothing more. In Webb and Jensen he found no suggestion of an insoluble depolariser used in conjunction with a carbon pole. He found no direction as to the consistency of the pastes relative to conductivity. He did not think that Webb and Jensen could fairly be said to direct the plaintiffs' particular mode of advantages. In Castle Smith there was no prescription for either paste. He found that a substance which required setting like plaster of Paris was "ruled out." Gum would not set like plaster of Paris, and had not its characteristics. He did not know that gum and size were about as bad conductors as could be used. There was no hygroscopic suggestion in Castle Smith, and no suggestion of diffusion of depolariser. With regard to Bender, the Witness said that chalk would not set like plaster of Paris. He found no suggestion in Bender for making your depolarising agent into a paste, or anything of that kind. He found no direction to use hygroscopic elements in two pastes side by side. With regard to Thiebaut, there was not the slightest suggestion of two semi-solid pastes side by side. There was no direction to keep them damp by hygro copic means, and there was no suggestion to powder your manganese so that with water it would make a paste. He found no provision as to two pastes of any kind side by side. Thiebaut's would not lead him in any way to get the plaintiffs' particular mode of construction. It was common knowledge that depolarisers should not come into contact with the zinc. He did not know of plaster of Paris being used in other dry batteries, but he was not familiar with many types of dry batteries.

Mr. BUTLER, examined, said he was the manager of the Electrical Power Storage Company, and was himself concerned with the manufacture of the Burnley batteries. In 10 years they had sold about 1,250,000 cells. The Obach cells competed with them. In 1897 there was a falling off in the sales of the Burnley cells. The Hellesen was not sold in England until after 1890, and that was not as good as the Burnley. During the 10 years no cells competed with the Burnel except the Obach.

Mr. MAY, laboratory superintendent of the Electrical Power Storage Company, examined, said that he had had a large experience in

but the only statement as to a power of attorney was one from F. R. Bright alone, which was not produced. The shares were

used for the manufacture of dynamos, but they need not deal with that in this case. The result of that has been that this invention

by the Patent Exploitation, Limited, Lord Street, Liverpool, for an injunction to restrain the defendants from infringing the letters patent No. 1,110 of 1890. An alternative claim was made for damages.

dry cells, and in connection with them had done a large amount of experimental work. He knew Thiebaut's specification. He had made various experiments on the lines of the first certificate of addition of Thiebaut's patent. In no case could he get the water to go to the bottom of the mixture. In following the directions he found in Thiebaut, he did not succeed in fashioning a dry cell, although he tried very hard to do it. Conductivity was better maintained in plaster of paris than in gummy materials.

Cross-examined by Mr. Moulton: It depended upon the paste used to show what the efficiency of the battery was. The particular efficiency of his experiments depended upon the paste he used.

Mr. Harry Theodore Barnett, a member of the Institution of Electrical Engineers, examined, said that he was some years ago engaged by the Electric Construction Corporation, Limited, to introduce the Burnley battery to the trade, and for that purpose he travelled a great deal over the United Kingdom and saw a great many people. In his opinion there was no commercial dry battery in the market which could compete with the plaintiffs'. The Gassner was occasionally brought down by clients to be tested, and in every case, where it was not absolutely inoperative it gave very little current or efficiency. The bulk of the Gassner batteries brought down were found to be practically inoperative. He never found the Gassner battery in commercial use. As far as he knew, the plaintiffs' was the first battery made in this country to be of any commercial use.

Cross-examined by Mr. Moulton: He knew nothing about the construction of the Gassner battery. Dry batteries were used largely for telephones. Dry Daniell cells were largely used in the telegraph world.

This being the close of the plaintiffs' evidence, Mr. Astbury summed up the plaintiffs' case. He said his Lordship would gather it was one of those cases where the room for invention was very small in area. Whenever a man made an invention of a well-known article, having well-known parts, put together in a perfectly well-known way, and made an article which was otherwise commercially useless into an article of enormous value, the defence always was that there was no room for invention.

His Lordship: What do you say the invention is?

Mr. Astbury said it was abundantly clear that whatever it was, an article made in conformity with the directions had made a great trade. Nobody denied that. It solved the problem which people tried to solve and could not.

His Lordship said he wanted to know what the patentee claimed?

Mr. Astbury replied that the invention was the construction and arrangement of parts of a well-known article.

His Lordship: Your first statement is that your patent is for construction and arrangement?

Mr. Astbury: Yes; nothing else.

His Lordship: Then tell me what parts he claims.

Mr. Astbury said he would begin with line 26 of the specification. The materials mentioned as electrodes and as exciting and depolarising agents, and the proportions of those agents, you might vary.

The first thing was to see what must be the limits of variation. The patentee used two pastes in a semi-solid state. "One in contact with the negative electrode, having intermixed with it depolarising agents, and one in contact with the positive electrode having no such depolarising agents in its composition." The next thing he did was to make definite instruction as to hygroscopic provision in each paste. The patentee said "or other hygroscopic analogue." The paste must be a paste which will set, but having set to a semi-solid, is a damp paste, and the patentee showed how to make it. The patentee had given directions which had led to an enormously useful thing for commerce. The defendants not only copied the plaintiffs' invention, but copied it with the greatest minuteness. They make their battery absolutely like the plaintiffs'. There was not a word of cross-examination as to that.

His Lordship said that after the evidence, he took it that the defendants did not deny infringement.

Mr. Cripps said that he certainly understood that.

Mr. Moulton did not think it had been proved that the materials were the same.

His Lordship: No, not the materials the same.

Mr. Moulton, in opening the defendants' case, contended that the plaintiffs' claim was too broad. The patentee claimed having both his electrolytes in the form of paste or semi-solids, and any use of these he said came within his claim. It was necessary to refer to the words of the claim very carefully. The claim was so broad that it limited the whole manufacture of batteries. He (counsel) felt perfectly satisfied that the specification was drawn up with the intention of telling the world that if you chose to use both your electrolytes in the shape of paste, then you were using this patent. The monopoly claimed was so wide that he did not know where the monopoly could be said to end in the case of dry batteries. The meaning of a claim was, he thought, the meaning to persons who read it carefully with an intelligent mind, and with the intention of ascertaining what the particular monopoly was. He wanted to show that there was not one single word in the specification or claim which could suggest the intricate and elaborate meaning which his learned friend had tried to put upon it. Where his learned friend had got that from was not from the language of the specification or claim, but from the necessities of the case. The claim was "a galvanic battery, having the space between its positive and negative electrodes filled with a semi-solid or plastic exciting agent in two layers, the one layer in contact with the negative electrode having depolarising agents intermixed therewith, and the other layer in contact with the positive electrode, having no such depolarising agents, substantially as set forth."

His Lordship: He claims the construction and arrangement of a galvanic battery. He does not claim a galvanic battery. He means: "I claim the construction and arrangement of a galvanic battery in manner aforesaid."

Mr. Moulton agreed. The learned counsel then read the specification, and said that not one of the ingredients the patentee mentioned was new. It was common knowledge to use them. He guarded himself by using the word "preferably," so that it was obvious he did not base his claim on the ingredients he mentioned. What he (counsel) said the patentee meant to claim, and did claim, was having both the electrolytes in a pasty or semi-solid condition. If they were right in that, the admissions the plaintiffs' witnesses had made were amply sufficient for the defendants' purpose because of this. Long before this time it was known perfectly well that the physical condition of the electrolyte was a matter of option. You might have it a fluid or you might have it a paste. The optional character of the physical condition of the electrolyte was a matter of common knowledge. Common knowledge had to be read into every specification both for and against the patentee.

The hearing was again adjourned.

Bright's Light and Power Company, Limited.

The case of Bright's trustee *v.* Vidal was mentioned on 24th inst. before Mr. Justice Swinfen Eady in the Chancery Division. Mr. Eve, K.C., and Mr. Van Neck represented the plaintiff, and Mr. Elgood appeared on behalf of the defendants. The motion was one by which the Court was asked to restrain the dealing with certain shares in Bright's Electric Light and Power Company, Limited.

Mr. Eve, for the plaintiff, said that already an undertaking had been given by the defendants not to transfer or otherwise deal with the shares pending the hearing of the action. It appeared that in September or October, 1900, the company's agents in Buenos Ayres became indebted to the company to the extent of £6,000. The view of some of the directors—Colonel Hayworth among them—was that this £6,000 should be accounted for and remitted from Buenos Ayres to this side. Thereupon they cancelled the power of attorney held by the agents and appointed a bank to act for them on that side. This did not suit the persons who were pulling the strings, and accordingly they presented a requisition requiring the directors to convene a meeting for the purpose of removing the members of the then board and substituting another board. That was on October 4th last. The board declined to summon a meeting, and thereupon on December 31st the requisitionists sent out a notice summoning an extraordinary general meeting of Bright's Light and Power Company to pass resolutions for the removal of all or some of the old directors and to appoint other directors in accordance with article 51. Mr. Vidal was a signatory to that requisition. The meeting purported to have been held on January 12th, and a resolution passed removing certain directors and substituting others. This state of things being brought about, a dispute arose as to which was really the board, and counsel was instructed that an action was commenced, which was pending before Mr. Justice Buckley, and a receiver and manager of the company (Mr. Welton) had been appointed. Then a motion was pending before Mr. Justice Bryne for the purpose of removing Mr. Welton as receiver and manager. Counsel submitted that pending the trial of this action it would not be right that the holders of these shares should be entitled to vote in respect of them. There were 6,183 shares. The defendant Vidal was transferee of the shares to secure payment to him of £11,100—it almost made one's mouth water—for services rendered in the nature of legal advice to Mr. F. R. Bright, brother of Charles Bright. He added that the bankrupt left the country after the receiving order was made against him, and claimed to control meetings of the board which had been held in Boulogne.

After hearing Mr. Elgood,

His Lordship said that he was of opinion that the plaintiff had made out such a case as required and compelled the Court to grant an injunction in terms of the notice of motion until the trial of the action. The plaintiff was trustee of the property of Charles Bright, the bankrupt, and the defendant was Mr. Vidal and a company called Bright's Light and Power Company, Limited, and the motion had reference to 6,183 fully-paid shares in that company. There was a dispute between the bankrupt's trustee (the plaintiff) and Vidal as to the ownership of the shares. The plaintiff's case was that they belonged to him in his capacity as trustee. Vidal claimed the shares as having been transferred to him in respect to a claim of £11,100 for legal advice and services and expenses incurred for one Frederick Richard Bright. Upon the facts it appeared that the shares were issued to Charles Bright and originally stood in his name. Plaintiff said that was because he was the beneficial owner of the shares. Defendant said that Mr. Chas. Bright was then trustee for F. R. Bright or his firm. An arrangement had been referred to, made in November, 1898, whereby the company purchased certain power stations in Santiago, and elsewhere, from F. R. Bright and his partners, and the consideration was in shares of the company, and all the shares so paid for were put into the name of Chas. Bright or other nominees. In order to see whether there was any confirmation of the story, his Lordship asked for the contract. The transaction was represented as being a sale of property at Salta and Santiago for shares, and no contract had been produced, nor was there any evidence of any contract having ever been entered into between the defendant company and the firm comprising F. R. Bright and his partners. Then it was said that Charles Bright was acting under power of attorney for the firm;

specification described a great deal more than any one cell. It described a method of solidifying the electrolyte for secondary batteries—accumulators. The Hellesen cell differed in several ways from Castle Smith's specification. The outer liquid was not a sticky stuff. The carbon in the Hellesen cell was made hollow with a lot

1897 there was a falling off in the sales of the Burnley cells. The Hellesen was not sold in England until after 1890, and that was not as good as the Burnley. During the 10 years no cells competed with the Burnel except the Obach.

Mr. MAY, laboratory superintendent of the Electrical Power Storage Company, examined, said that he had had a large experience in

but the only statement as to a power of attorney was one from F. R. Bright alone, which was not produced. The shares were transferred from the name of Charles Bright to the name of Mr. Fudge, and it appeared that after the act of bankruptcy committed by Chas. Bright, and after the date of the receiving order, Fudge was directed to transfer, or requested to transfer, and Fudge did transfer, 6,183 of his shares into the name of Vidal. Plaintiff's case was that that transfer was merely to put further difficulties in the plaintiff's way to establish his title. On behalf of Vidal, it was said that the transaction was entered into with a view of giving him security for his claim against F. R. Bright. It could not be disputed that there was a substantial question to be tried, and Vidal might have considerable difficulty in establishing his claim to the shares. On the materials at present before the Court, Vidal had not proved that the shares belonged to him. The question of what ought to be done till the trial remained; there was a conflict of evidence as to the facts since the date of the receiving order, and with regard to the fact that a meeting had taken place at Boulogne, and that Charles Bright, although not a director, had attended the board meeting, exercised considerable influence, and claimed to control the meeting. His Lordship was satisfied there was a great deal more behind, and that the proceedings which had been taken with regard to the dealings in these shares, and the attempts made to control the company, could not be justified. The defendant Vidal must be restrained, not only from dealing with the shares, but from voting upon them, until the action was tried, and he made an order accordingly in terms of the notice of motion.

A motion by the plaintiff against one Morino stood over on an undertaking given by Mr. Peck, representing the defendant, in terms of the notice of motion, for a week.

EMPLOYERS' LIABILITY CLAIM.

AT Marylebone County Court, on Monday, Matthew Foley, an electrical engineer's navvy, claimed £50 damages under the Employers' Liability Act, against Callender's Cable and Construction Company, Limited, in respect of personal injuries alleged to have been sustained in consequence of negligence on the part of the defendants or their servants. The plaintiff stated that in September last he was in the employment of the defendants, his salary being £1 10s. 7d. for a week of 52½ hours. On September 28th he was assisting in laying electric cables in trenches along Seymour Street and Wigmore Street, his chief duty consisting in handing pails of hot pitch to other men, who poured it into the iron channels holding the cables. With a view to avoiding injury through the splashing of the hot pitch, the men wore large, thick leather gloves or gauntlets, supplied by the firm. Finding that a pair of these gloves which he secured was shrunken and cracked, he (plaintiff) took the precaution to put on a second pair over the first. A pail of the pitch was placed on the ground by one of the other men for witness to pass along the trench. He caught hold of the two handles of the pail, but found that, owing to it being too full, some of the pitch had run over and stuck the pail to the ground. He gave another pull, when the pail appeared to tilt a little, causing a quantity of the boiling pitch to fall upon his right hand. Had the gloves been whole, and of the proper length, no injury would have resulted, but, owing to their being cracked or torn, and not being long enough to cover the wrist, he sustained a terrible burn. Owing to the injuries, he had not been able to do any work since the day of the accident.

COUNSEL for the defence submitted that there was no evidence of negligence for which the defendants were responsible, to go to the jury; Judge STONOR dissented.

Evidence was given for the defence, including that of Mr. PERCY MOSSUP, second engineer to the Charing Cross and Strand Electricity Supply Corporation, Ltd., who stated that he had had some 15 years' experience in such work as that in question, and he believed that the gloves, as worn by the plaintiff, were such as were generally used for the work.

Other evidence to the same effect having been given, the jury returned a verdict in favour of the plaintiff, assessing the damages at £20, and judgment was given accordingly, costs being allowed on the scale above £20.

THE AMERICAN STEEL AND WIRE COMPANY, LIMITED, *v.* W. T. GLOVER & CO., LIMITED.

THE SAME *v.* FELTEN & GUILLEAUME.

W. T. GLOVER & CO., LIMITED, *v.* THE AMERICAN STEEL AND WIRE COMPANY, LIMITED.

THESE actions all came on before Mr. Justice Farwell on Tuesday last, in the Chancery Division of the High Courts of Justice, London. The first two actions were discontinued, and the Court had only to deal with the third, that by Glover & Co., Limited, a Manchester firm, against the American Steel & Wire Company, Limited, in which an injunction was asked to restrain the defendants from infringing Edmunds's patent, No. 3,119 of 1893, for improvements in the formation of solid ends in connection with flexible or compound electrical connectors. Mr. T. Terrell, K.C. Mr. C. F. Jenkins, K.C., and Mr. Frost represented the plaintiffs; and Mr. Fletcher Moulton, K.C., and Mr. A. J. Walters appeared for the defendant company.

Mr. TERRELL, in opening the case, said that the patent which the defendants were alleged to have infringed was No. 3,119 of 1893. The patent had reference to the manufacture of what were called bonds for rails for electrical purposes. They might also be used for the manufacture of dynamos, but they need not deal with that in this case. The result of that has been that this invention has been unanimously adopted throughout the electrical world for the purpose of connecting rails together. What the defendants had done was to start making a solid end, and they took out a patent for it. The infringement was admitted. The defendants took a bundle of wires and made a sleeve, and heated the sleeve and the bundle of wires very hot—white hot—and then by a great compression they jammed the two together and made them solid. The plaintiffs said that that constituted an infringement of Edmunds's patent. It would, of course, depend upon the construction his Lordship put on the plaintiffs' specification whether it constituted infringement of Edmunds's patent. His learned friends on the other side raised several issues. They said there was no subject matter in the plaintiffs' patent. But how they could say that, he (Mr. Terrell) did not know. The defendants had brought an action complaining of infringement of their patent for making the solid end in a particular way, and when he discontinued that action, his solicitors wrote to the plaintiffs a letter—which the plaintiffs were entitled to rely upon—stating that they discontinued the action, their reason for discontinuing being because there was no proof that the plaintiffs had infringed the particular way the defendants adopted. The learned counsel then read the plaintiffs' complete specification, the claim in which was "Flexible or compound electrical conductors provided with solid ends in the manner hereinbefore described." The learned counsel submitted that the construction of the specification was the making a solid end of the same metal by applying it to the end of the wires at the requisite temperature—preferably the most convenient method being casting on.

Mr. JAMES SWINBURNE, electrical engineer, examined by Mr. TERRELL, said that the plaintiffs' specification was clear; his arrangement was new at that date, and it came into general use. The importance of the conductor being flexible, and the end solid was that there would be no break in the conductor even if there were movement in the rails.

Mr. PHILIP DAWSON, examined by Mr. TERRELL, said he had read the plaintiffs' specification, and he knew of the application of rail bonds with solid ends of the same metal to electrical engineering generally. Rail bonds made with solid ends of the same metal had been a great commercial success. No engineer would specify any other sort of bonds than those in a contract. The only method which had proved satisfactory, in his experience, was the one-metal bond.

Mr. BEAUMONT, an electrical engineer, also gave evidence in support of the plaintiffs' case. He said he had studied the plaintiffs' specification. In his experience the want of a flexible conductor in rail bonds was widely felt until these, the subject matter of the present action, were made. Before 1893 he had never heard of such a thing as a one-metal bond.

Mr. TERRELL having intimated that this was the plaintiffs' case, Mr. WALTER said he would not waste time by addressing his Lordship at that stage, but would proceed at once with his evidence.

Sir FREDK. BRAMWELL, examined by Mr. WALTER, said he had read Edmunds's specification. The process he found described in it was to take a group of metallic wires, put the ends of those wires into a mould, and pouring metal into that mould to fill it and embrace the wires. So far as that was a process of binding two metals together, it was not new at the date of the specification. As regarded the specification itself, there was nothing limiting the scope or kind of the metal composing the wires or fixing the ends. "Burning on," in the sense used in this specification, was commonly known in connection with metals of all sorts at the date of the specification. In his opinion the defendants did not use the process claimed by the plaintiffs. "Casting on" was at the time of the specification a known method of joining metals.

Mr. DUGALD CLERK, examined by Mr. WALTER, said he was an electrical engineer, and had designed machinery for some of the largest works in the Midlands. He knew the plaintiffs' specification, and there was not a word about welding in it, or anything to teach the world that one could weld copper together. He was speaking of "welding" as distinguished from "burning." The defendants' rail bond was welded.

In cross-examination, WITNESS said that the article made under the specification of 1893 was superior to anything they had had before.

This being the defendants' case, Mr. WALTER addressed his Lordship on behalf of the defendants.

At the conclusion of the arguments of counsel, his LORDSHIP said he did not think he should gain anything by reserving judgment. He thought the construction of the specification was plain. He agreed that it was a patent for a process. He thought that where the patentee alluded in the specification to metals he alluded to all metals. He thought that the claim was for an old process, as it had always been applied to substances in the way hitherto applied. His Lordship could see no sort of invention at all in it. What the defendants did was to "weld," and reading the plaintiffs' specification by the light of scientific knowledge, at the time he thought the intention was not to include welding, because it was not known at the time that you could weld copper to copper. In his opinion the action failed, and must be dismissed with costs.

THE SUPPLY OF ELECTRICITY TO THE ST. ERMIN'S HOTEL.

IN the Chancery Division on 24th inst., before Mr. Justice Kekewich, Mr. Warrington, K.C., and Mr. Mitchell renewed, on behalf of Mr. Husey, the receiver in possession of the St. Ermin's Hotel Victoria Street, Westminster, his application for an injunction to

negative electrode having depolarising agents intermixed therewith, and the other layer in contact with the positive electrode, having no such depolarising agents, substantially as set forth."

been entered into between the defendant company and the [illegible] comprising F. R. Bright and his partners. Then it was said that Charles Bright was acting under power of attorney for the firm;

restrain the London Electric Supply Corporation from cutting off the supply of electricity to the hotel. The Hotel Company were indebted to the defendants for electricity supplied, but though the Receiver had offered to pay for all electricity supplied during the time he had been in possession, the Electric Company declined the offer, they contending that the supply previously supplied might be paid for. The question now before the Court turned mainly on a point of law, the plaintiffs submitting that the Electric Supply Company had no power under the Acts of Parliament of cutting off the supply to the premises, and that the company could not decline to supply him simply because the persons previously in possession had not paid their bill. For the Electric Company it was said that the defendant had not given the requisite notices, and that he had not brought himself within the provisions of their provisional order. His LORDSHIP came to the conclusion that the plaintiff was entitled to a supply of electrical energy, but that he must serve the requisite notices and enter into a contract. In the meantime, however, the supply of electricity must be continued.

CORRESPONDENCE.

The Electrolytic Transmission of Sulphur.

In an article on "Cataphoresis" in the ELECTRICAL REVIEW of December 27th, 1901 (Vol. 49, No. 1,257), Dr. W. S. Hedley subjects to somewhat severe criticism a paper on "The Electrolytic Transmission of Sulphur from the Harrogate Sulphur Water Through a Pig's Skin, and Its Therapeutic Value on the Human Subject Under Similar Circumstances in Eczema, Gout, &c.," published by me in the *Lancet* of August 10th, 1901.

In this paper I have described the results of experiments in which sulphur is deposited on electrolysis of the Harrogate sulphur waters.

In my capacity as a medical man, I have, no doubt, been guilty of interpreting and communicating the results of these experiments in unconventional terms, making use of expressions unacceptable to the trained electrician and chemist. The experimental facts, however, are not in any way thereby affected.

In a corrected form, the description of my experiment would be as follows:—"A piece of pig's skin was tied round the mouth of a cylindrical vessel, the bottom of which had been previously knocked out. A piece of blotting paper was placed in contact with the outer side of the pig's skin, the blotting paper resting on a platinum plate, which was connected to the positive pole of a battery. The vessel was then filled with Harrogate sulphur water, and a metal plate connected with the negative pole of the battery was then introduced into the vessel. The battery consisted of 13 accumulators, and the strength of the current flowing through the circuit was 3 milliamperes. This current was passed through the water for half an hour, at the end of which time a deposit of sulphur was found on the pig's skin, and also on the blotting paper."

The explanation of this deposition on the basis of modern electro-chemical principles is, that, under the influence of the current, the cations wander towards the cathode, the anions towards the anode. The sulphuretted hydrogen present in the water is then probably oxidised by the freshly discharged anions (from the chlorides, sulphates, &c., in the water), whereby separation of sulphur takes place in the neighbourhood of the positive pole.

In the case of alkaline sulphur waters, we may suppose that a portion of the sulphuretted hydrogen will be present in the form of alkaline sulphides. In such cases some of the deposited sulphur may be the result of the discharge of sulphur or sulphydrogen anions. The greater portion of the sulphur deposited appears, however, to be the result of the first process.

In connection with the above experiment it should be pointed out that the blotting paper, which was not by any means free from moisture, and the pig's skin merely represent porous septa placed in the solution between the two metallic electrodes. The presence of these porous solid substances affords points of condensation for the oxidised sulphur as it forms in the solution, and the sulphur is accordingly precipitated on the pig's skin and the blotting paper.

The appearance of sulphur on the pig's skin under the conditions of the above experiment recalls an experiment of Daniell in which two solutions, one of dilute caustic potash, the other containing copper sulphate, separated by an animal membrane, were subjected to the action of the current, the positive pole being immersed in the copper sulphate solution. Under these circumstances a deposit of metallic copper was formed on the interposed membrane.

In conclusion, I must express my indebtedness to Dr. Hedley for having pointed out the inaccuracies contained in the previous description of my experiments, and hope by this explanation to remove any reflections likely to be cast upon the cataphoric method of treatment which has been so successful in my hands at Harrogate, in eczema, gout, &c.

Francis Wm. Smith, M.D. Aberdeen.

Harrogate.

Machine Tools.

I have read Mr. Bathurst's articles on machine tools, and they give me the impression that his knowledge of modern machine tool practice was principally acquired at the Glasgow Exhibition.

On p. 889 he says: "An interesting point of detail, showing that the design has been carefully evolved, is noticeable in the provision of a small oil reservoir on the tail-stock casting, together with an oiling pin." This looks as if he had very little to do with a variety of lathes, or else is not observant, as half the English makes, and nearly all the American patterns of lathes, have this oil cup.

Again on p. 21, referring to a wet twist-drill grinder, he says: "With the wet wheel the grinding can be forced as fast as the wheel will cut, without any possibility of softening the drill, and it, therefore, grinds with maximum efficiency, and as the temper of the drill is not withdrawn it can be sharpened in the least possible time." It would seem that Mr. Bathurst has not done any grinding on wet grinders, for even when the emery wheel is deluged with water it is not in the least difficult to soften the drill if forced too hard against the wheel. This is specially the case when the cutting edge is against the wheel, as it forms a scoop which takes the water off the wheel, and leaves only the comparatively small amount of water in the porous emery to cool the part of the drill behind the cutting edge.

Of course I allow there is nothing like the chance of softening the drill that there is with a dry wheel, still, to say "without any possibility" is putting it rather strong.

Talking of a radial drilling machine, he mentions an index table fixed below the cone pulley, to give correct driving position for different sizes of holes, which he says "enables an unskilled labourer to operate the machine as efficiently as the high-class workman." Perhaps he doesn't consider setting the work on the machine as part of the "operating," but this is the principal part in most cases, and when once the work has been set, which cannot be done by an "unskilled labourer," the changing of the belt to the right speed is a job hardly worth having a labourer in to do. The table may save the skilled workman a moment's thought, but it certainly does not warrant putting an unskilled labourer at the machine.

Lastly, I read "When tapping, the feed wheels may be thrown clear of the spindle, which is then left free to follow the tap. This saves breakage of taps." Mr. Bathurst apparently thinks that tapping is sometimes done with the self-acting feed in gear, but this is obviously impossible, if the tap be fixed in a chuck firmly to the end of the spindle. It is the usual practice to throw out the automatic feed and let the spindle follow the tap. If the feed cannot be thrown out, tapping is impossible without some special form of tapping chuck. Thus I cannot see where the saving breakage of taps comes in.

As for Mr. Bathurst's last article on "Screw Machines," it reads as if he had taken down a salesman's description in shorthand, and then copied it out.

If I have misunderstood any of the passages referred to, I should be pleased if Mr. Bathurst would put me right.

H. W. A.

I note that "H. W. A." criticises one or two verbal points in my article on "Machine Tools," and count myself lucky that such a "know-it-all" authority has not subjected

me to greater criticism. My remarks (purposely based upon what I was able to observe at the Glasgow Exhibition) were designed more for the ordinary than your expert reader, but "H. W. A.'s" criticism will doubtless do good as laying further stress upon such points as I tried my little best to bring out. One would think that a salesman's description should certainly distinguish one particular make from any rival make of machine, and whilst disclaiming the useful accomplishment of shorthand, I certainly own to having sought information from the respective representatives rather than borrow list descriptions from too numerous catalogues.

Taking "H. W. A.'s" first criticism, I might have made it more clear that the oil reservoir on the tail-stock casting of a lathe was first evolved (perhaps five years ago) by the American maker in question in the particular class of lathe dealt with. It is a fact that the idea has now been generally adopted by other makers, and the sooner *all* (that is, the other half) of the English makers take it up, the better lathe users will be suited.

If "H. W. A." will read the word "*must*," instead of "may," he will not be able to make "the obviously impossible" from my radial-drill description. When writing this paragraph I had in mind the simplicity of the gear, also due, I believe, to American makers, by which the automatic feed of a drilling machine spindle can be so readily thrown out of action, as compared with the original English type.

Possibly I "put it rather strong" when comparing "wet" with "dry" drill grinders, but so long as we are both agreed on the superiority of wet grinding, I am glad to have "H. W. A's." criticism as tending to soften my description.

It is perhaps irrelevant to ask what particular axe "H. W. A." is wanting to grind, but if he has achieved his purpose, the editors will also have had the advantage of discovering a writer who can deal with the subject with a keener edge than myself, in case "H. W. A's." services can be requisitioned later on.

Fred. Bathurst.

Large Engines for Traction Work.

If there is any space left in the columns of your paper for a further expression of opinion on the above subject, I shall be glad if you will allow me the privilege of a few remarks.

I read with interest the article in your issue of January 17th, and entirely concur in the opinions set out therein. Since then there is an echo from Patricroft, which is still reverberating in the valley of the "classic" Irwell, and is now, perchance, speeding across the Atlantic to spend its last efforts on the shores of Lake Michigan, somewhere in the neighbourhood of Milwaukee. The gameness of the challenge thrown out from Patricroft is to be admired, that they can build engines there equal to, and better than, the Americans. This is just as it ought to be, and is the proper style in which to meet the bogey that American engines are the best in the market. I have never been able to understand why it was that Glasgow, the very centre of engineering, had to go to America for engines; surely this is a case of carting coal to Newcastle; but I forgot that Glasgow is a philanthropic city, and, may be, it was to give her unemployed list of engineers and greasers work in keeping the engines running, for goodness knows there are enough men around them to eat them. Engines of from 3,000 to 4,000 H.P. are being built and put into foreign-going ships, some of which run for 25 days without a stop, and one engineer, who does his own greasing, keeps them going round watch on watch, and they run without a hitch.

It is all very well for our American cousins to say "All can raise the flower now that all have got the seed." Where did America first get the seed? From Britain; I shall not say Scotland, in case I am deemed "clannish;" Britain is a good covering word. The nursery grounds of old England are just as capable to-day as ever they were of rearing good plants, only they want a little careful watering, and, perhaps, a little more manure. We shall see that they get it, so wake up Rugby, Birmingham and Patricroft!

A lot of talk has been heard about the saving grace of big crankshafts, &c.; where it comes in has not been shown. I am thinking now of a traction plant of 1,200 H.P. with a 13-in. shaft, but which, according to the B. of T. formula, would be ample at 11·5 in. for engines of a like power to propel ships across the Atlantic, the stormiest ocean in the world, which is, nevertheless, crossed with unfailing regularity. Anyone who has compared the stress put upon a shaft when engines race in a sea-way with the stresses to which a shaft is subjected when driving a traction generator, even under a short-circuit, must be convinced that in the former case the shaft has to stand the greater abuse. When a ship cocks her propeller out of the water, the engines may run up to three times their normal speed, and it is under these conditions that the propeller takes the water; the reverse is the case with the traction plant, as the speed is reduced at the time of overload. In any case, what is the benefit of a large crankshaft and a small crosshead pin?—simply the advantage of a $\frac{1}{2}$-in. link in a $\frac{5}{8}$ths chain.

I have subjoined here a comparative table taken from Mr. McKechnie's paper "Review of Marine Engineering during the last 10 years," showing the difference of diameters between shafts in 1890 and 1900. All these authorities have large interests at stake, and the small percentage of increase recommended shows that they have not disturbed themselves much at the big shaft epidemic. It will be observed that the Board of Trade have not thought fit to increase the dimensions of their shafts at all.

	Crankshaft. 1890.	1900.
Lloyd's	11$\frac{3}{4}$ in. dia.	12$\frac{3}{4}$ in. dia.
Board of Trade	11$\frac{7}{8}$ " "	11$\frac{7}{8}$ " "
British Corporation ...	11$\frac{3}{4}$ " "	12$\frac{3}{8}$ " "

The percentages of increase in the strength of the above shafts, made to existing rules, as compared with rules dated 1890, are as follows:—

	Crankshaft.
Lloyd's	17 per cent.
Board of Trade	0 "
British Corporation	17 "

Cample.

Improved Testing Tank.

In regard to your recent article on this subject, I cannot see how the writer can claim to have had a steady constant load on for any length of time under the conditions he mentions. For instance, supposing that he used tap water for the circulation, and that the temperature of the electrolyte was, say, 55° F. at the commencement of the run, and that after six hours' run the temperature (in spite of his water circulation) reached 208° F., an increase of 153° F., assuming these figures to be correct, then they show that, unless someone must have been constantly increasing the distance between the two electrodes, or altering the density of the electrolyte, with a rapidly rising temperature like the above, he would have had a very heavy load rapidly put on the engine and dynamo.

Therefore, in either case, seeing that it *must* have been necessary for someone to be constantly varying one or the other, to keep the load down, I cannot see how he can claim to have very much improved matters, for it appears quite clear that had he continued the load for, say, half an hour longer at the rate the temperature was rising, it must have soon been boiling, and then the old complaint reappears.

My experience has taught me that to obtain a constant steady load in the true sense of the word, say, for an official trial, or water consumption on engine, or for the purchaser's satisfaction, you must not allow the conditions of the electrolyte to vary in any marked degree, either in temperature or density, or even the distance apart of anode and cathode, as with any departure from these conditions, there will not be a satisfactory steady run.

The tank that I have generally used for a water resistance is the ordinary oblong tank, with an overflow, and a good water circulation straight into the tank, thus constantly changing the whole of the electrolyte, and so keeping the temperature fairly constant, and on no account add either before or while working, any salts, sodas, or, in fact, anything to alter the conductivity or density of the electrolyte, beyond the conditions from which it was drawn.

In a tank, say, 8 ft. long × 4 ft. × 3 ft., I have tested dynamos ranging from 10 up to 700 B.H.P., with voltage

varying from 10 up to 3,000 volts, also amperes from 5 to 1,200 amperes, both continuous and alternating-current machines, but with different waters.

I should like to ask Mr. Lindley if he considers the tank mentioned a good one for high-tension work, seeing that it is intended for general engineers.

Yrreb, *Electrician.*

Birmingham.

Soldering Fluid.

Seeing a correspondent's inquiry for soldering fluid, I have used the Burnley soldering paste on our mains for the past three years, and in the U.S.A. for several years before that. It can be purchased here in England. I do not know the address just now, but could obtain it if wanted. I have enclosed a small sample, so that you can see what it is like. It makes a perfect joint, and does not corrode at all, and it can be used for almost any metal.

H. F. T.

Shanklin.

[This appears to be the same jelly-like substance which we noticed in our "Notes" columns some time ago. We can vouch for its efficacy, but have never used it for insulated joints.—Eds. Elec. Rev.]

Electric Fitting for Baker's Oven.

In answer to a correspondent regarding special fitting for a baker's oven, I think he would get all that is required by adopting a patent adjustable support for electric lamps, as the light could be so fixed as to slide into the oven the whole length when required, and be withdrawn when not in use.

Reader.

The Tramway Junction at Sheffield.

In your issue of 24th inst., "Electric" again appears with his usual egotism; I neither misunderstood nor purposely ignored his previous arguments. "Electric" must not think that it is not admitted that by using *castings entirely*, instead of rails, something unique has been done; but as a junction, I again assert there is nothing unique or greatly difficult about the construction (not material) as can be seen, within easy distance of Sheffield, on several tramways, both constructed and being constructed, where a greater number of points and crossings are confined in a similar space, and with variable gradients and curves; but as these are more or less made up with intermediate rails (although in some cases at considerable distances between), I suppose "Electric" does not consider them worthy of comparison.

What boldness is there in a rich Corporation spending a few hundred pounds, or even a manufacturer (as at Sheffield), to prove in time that either the material or method of construction is superior to previous systems?

I note "Electric" has been engaged 17 years upon, he thinks, 17 different tramways (there are not 17 different systems); amongst these I wonder how many were electric? His engineering knowledge I presume enabled him to glean in a few months all that could be learnt upon any one of these tramways, whilst I have only had 11 years' actual construction and maintenance work upon *one* electric tramway, with a total of 30 years upon two tramways as a permanent way engineer; but these are, I believe, amongst the five largest systems in Great Britain.

When "Electric" has had a few years' experience practically of modern electric tramways, their construction and maintenance, he will not be so ready to style super-elevation, gauge, and position of points and crossings, &c., as a "mere copybook phrase"; he will then have found out that what in his present opinion is mere clap-trap is the real essence of construction, and will tend towards smooth and better working and longer life to the materials used.

I am sure that in the construction of this junction these questions had to be considered, whether "Electric" had anything to do with it or not.

I have constructed a large number of junctions and been responsible for the maintenance of some, so that I think I can fairly claim the title of P.W.E. I have seen seven different classes of material tried and tested; four are long since out of the race, and, after seven years, one has been selected for general use, at any rate, for the present.

Over one particular trial lot 4,500,000 cars passed, and at the present time American material is being similarly tested under the same conditions, and the results are awaited.

"Electric" asks, "What is the object of this discussion?"—from his point of view, apparently an advertisement; from mine, a desire for practical results; and, while I question whether "Electric" is the voice of "many professional men," I am sure that few practical tramway engineers will accept him as their mouthpiece in so narrow a groove as that selected.

I think we should not place all the blame upon manufacturers, even if some of the materials used in this country have not been suitable for electric traction. Let our consulting engineers and resident engineers take a fair share, as they frequently design, and in nearly all cases set out, the curves, and give the various angles for the manufacturers to work to, the latter very rarely seeing the track until laid—if then.

Many of the old designs are obsolete, and must be discarded, but my experience is that English makers are quite willing to follow up any improved designs that may be put before them; I do not believe that America produces material better suited for the work, but the designs, I must admit, are frequently superior to those of many of our English engineers, which must have a bearing upon the length of life of English material, combined with the faulty fixing of it.

English engineers are charged with copying foreign lines; this may be so in isolated cases. I hold no monopoly of experience, only what has been gained from my everyday duties, and careful watching of the traffic requirements.

If "Electric" will again make the round of the tramways, he will, perhaps, find a great deal has been done towards the improvements in construction he so much longs for, both in design and method of construction, and actually by those who have *not copied*, but relied upon their own brains and experience.

In conclusion, permit me to add that I hold no brief for anyone, but am entirely independent of manufacturers, being only a

Permanent Way Engineer.

The Conversion of Our Railways.

On the last page of your issue of the 24th inst. there appears, under the above head, an editorial article in which you traverse the view expressed by me in a letter addressed to the editor of *Electrical Investments*, "that it is to the main lines I look for the greatest success in the application of electrical power," and you otherwise reprove me because I have not preferentially urged the conversion of suburban lines.

It would appear that your article has been written under a misconception. My letter, the extract of which forms the basis of your comments, was addressed to your contemporary in relation to an article which appeared in the previous week's issue, entitled "The Coming Conversion," in which reference was made to the possibility of the electrical equipment of *branch* lines preceding that of the main lines. No reference whatever occurred in this article, nor has any reference been made in my letter, in the paper to which you refer, or in any address delivered before the members of the Institution of Electrical Engineers to suburban lines, nor do I see the need for any such reference, for the main-line portion of a suburban line is equally a main line with the main line of the Midland or any other company.

Throughout the position which I have taken has been: that for electric traction to prove remunerative the traffic must be so evenly distributed and so continuous as to constitute a fairly constant load, and I have, as in the instance to which you refer, pointed out that *branch lines* would not, as a rule, subscribe to these conditions, because branch lines are, and must be, largely dependent on the main line trains which stop at the junction which serves the branch.

I have further pointed out that when the time arrives for the main lines to be served by electricity these branches may

then with economy be served from the main-line generating station.

It is quite true that I have consistently urged the undesirability of attempting to equip branch lines in anticipation of the main lines, for the reason that should such not prove economical in its results, it would have just that effect your view of my advocacy in favour of "main lines" has assumed, viz., to retard the application of electricity.

I have chosen main lines for comparison, because in their conversion is to be found the greatest economy. The conversion of all suburban lines is but a consequence of the conversion of the Metropolitan, or the application of electrical power in the operation of other suburban lines. A *suburban* line is by no means a *branch* line, and my reference to branch lines can in no way affect the progress of electricity on suburban lines. On the contrary, if the suburban line is a well fitted *line*—as most suburban lines are, or they would not be there—my qualification in respect of a fairly constant load, together with the very suggestive remarks to be found in my address, should influence such railways in the opposite direction to that which your article would lead your readers to believe to be the effect of my advocacy.

May I point out that in your own remarks on the London and South-Western, the Brighton, South-Eastern, and other railways, you are yourselves advocating the conversion of probably the most important portion of those systems—all main lines.

Your article takes as its basis but a few words extracted from my letter. May I suggest whether this is quite fair to me. I enclose a copy of the letter, and perhaps if you can spare space you may not object to reproduce it. If not, your readers will find it in *Electrical Investments*' issue for the 15th inst.

W. Langdon.

Derby, *January 27th*, 1902.

[Our article was not written under any misconception. Mr. Langdon admits that he had never in any article, letter, paper, or address delivered, referred to the electrification of suburban lines, and, furthermore, states that he does not see the need for any such reference. What we criticised was Mr. Langdon's advocating the premature electrification of our main lines, when he might have done so much more good had he pointed out the importance of at once electrifying our suburban lines, regarding which there is no uncertainty either as to system, method of installation, cost of electrification, cost of operation, or results to be obtained, and advantages of the transformation. We read the article in *Electrical Investments*, which called forth the letter from Mr. Langdon which we criticised, and it appears to us that Mr. Langdon's first letter was written under a misconception as regards the meaning of the word "branch" line, as used in the article in question, which evidently referred to what we called suburban lines.

His letter also seems contradictory. In one place he says, "There is so much reason to believe that electrical energy will prove successful in the operation of *even* our main lines . . . . . that it is towards the application of electrical means that our efforts should be directed." And yet further on in the same letter occurs the sentence on which our article was based, where he says, "It is to the main lines that I look for the greatest success." If these two sentences mean anything, they would seem to indicate that Mr. Langdon admits that electric traction on main lines is a new idea, and would amount to an experiment.

Mr. Langdon entirely begs the question with his intricate definitions of main, suburban and branch lines. We should hardly have thought that this needed any explanation. The contention that the main portion of a suburban line is equal to a main line certainly does not agree with the meaning that most people would put on the word suburban line.

A train running from St. Pancras to Hendon does not cease to be suburban, simply because the route is identical with that taken by main line trains running North. Mr. Langdon states that a suburban line is by no means a branch line, and that he only referred to branch lines and did not mean to affect the progress of electricity on suburban lines. We should be glad if Mr. Langdon would explain to us what he means by suburban lines, and whether by chance in this case the definition is used instead of main lines. We never thought that anyone would suggest electrically equipping what is called by most people a branch line, that is to say, one having a few light trains in each direction per day.

We are glad to note that towards the end of the letter Mr. Langdon agrees with us. We are sorry to say that we cannot agree with him.

We cannot regard it as true that main lines will give the greatest economy by being electrically equipped, and it is not these that are most in need of it. On this point all traction experts are agreed. Electricity is peculiarly adapted to the congested traffic on the suburban lines of our large cities where the trains are heavy, with short distances between stops, and have to operate at as high an average speed as possible. We certainly did not intend to be unfair to Mr. Langdon, and if we have misunderstood him we greatly regret it.—EDS. ELEC. REV.]

London Electrical Contractors' Association.

Your reporter in taking his notes with reference to the meeting of the London Electrical Contractors' Association has not quoted the remarks of one of our members (Mr. W. R. Rawlings), when he says, "he said some hard things about consulting engineers." This remark would more fittingly apply to one of the speakers who preceded Mr. Rawlings, who followed by defending the professional gentlemen, and stated at the meeting that consulting engineers had done more than anyone else in upholding the interests of the trade, by maintaining a high standard of work, and followed on by stating that the consulting engineer was not a trader, and did not desire to be treated as one. That there are a number of contractors who pose as consulting engineers, was a point the speaker desired to make clear when speaking, and it is these individuals who cause the language which is so often heard in the condemnation of the consulting engineer.

The consulting engineer is a gentleman we contractors respect, and Mr. Rawlings would be one of the last to say one word against these gentlemen.

Trusting you will find space for this letter to prevent any misconception.

The London Electrical Contractors' Association,
EDWARD J. HOGAN, *Hon. Secretary.*

In reading through your issue of the 24th inst., I find that, in connection with the above matter, you have misreported both what I and others said on that occasion.

My remarks were, that many a time, when I had gone to see about a fittings order, I found that the consulting engineer or architect had placed the same at trade discount, and that therefore, as a contractor, I failed to make any profit; and I further stated that the company I was representing on that occasion had made it a practice to only give a 5 per cent. discount off their list prices to private individuals, and that for cash only.

I should be glad if you would make these corrections.

Justus Eck.

"Hatfield" Electrically-driven Feed Pumps.

With reference to Mr. Johnston's letter on the subject of feed pumps, we should like to inform your readers that by the kindness of Mr. Faraday Proctor we were afforded facilities for making some tests of the pumps supplied by us to him, and we are therefore able to give you some of the details asked for by Mr. Johnston in his letter of the 21st inst. The tests, the results of which we append below, had to be carried out under working conditions, and consequently there was no opportunity for making long runs. We do not put these tests forward as being correct within, say, 1 or 2 per cent., and their accuracy is not guaranteed by Mr. Faraday Proctor; but the figures were very carefully taken by one of our staff, and we are quite prepared to guarantee their accuracy subject to the above limitation. Unfortunately, we cannot give particulars of the full power test as we were unable to obtain a satisfactory run at full speed for more than a few seconds without inconveniencing the station engineers; but we think from the figures given that the

efficiency would probably have come out on full load at quite 65 per cent. or higher. If we assume an all-round efficiency of 50 per cent., and a steam consumption of 30 lbs. per KW.-hour for the generating engines, these pumps are using about 30 lbs. of steam per B.H.P. per hour. In contrast with this we find that as the result of some trials published by Mr. Faraday Proctor in one of your contemporaries, the steam consumption of steam feed pumps varied from 89·13 lbs. up to as much as 613 lbs. per B.H.P. per hour. We think that the superior efficiency of electrical direct-driven pumps is sufficiently obvious from the foregoing figures, and it must be remembered that in addition to this, the steam pump condenses a large quantity of steam, whether standing or working, the loss in the electrical leads being, of course, practically negligible.

We must apologise for the length of this letter, and trust you will insert it, as the matter is, we think, of considerable interest to station engineers generally.

We enclose you a copy of a letter received this morning from Mr. Faraday Proctor, and we shall be obliged if you will publish this also if you can find space for it.

The results of the tests were as follows:—

Load.	Revs. per min.	Amp.	Volts.	Gallons d/d per min.	Press: lbs. per sq. in.	Overall efficiency.
¾ speed	172	10·6	591·5	44·69	128	47·6 %
½ "	222·5	11·1	593	60·4	124	59·63 %
¾ "	291	13·85	587·5	78·43	122	61·37 %

Merryweather & Sons, Limited.

[COPY.]
City Electrical Engineer's Office,
Temple Back, Bristol,
Monday, January 27th, 1902.

DEAR SIR,—In reply to your letter of the 25th, I have not the slightest objection to your quoting the rough tests taken of your pumps at these works. As you say, these tests were not intended to be complete and scientifically accurate, but to the best of my belief they show proper results. I am very pleased with the way in which this pump is behaving since the foot valve was put in.

You are quite at liberty to make use of this letter should you desire so to do.

Yours faithfully,
(Signed) H. FARADAY PROCTOR,
City Electrical Engineer.

Messrs. Merryweather & Co.

The Testing and Management of Electric Motors.

Will you kindly allow me to correct an error in my letter which appeared in last week's issue of the ELECTRICAL REVIEW.

As I arrange for the motor starter to be put in on the negative main, the shunt lead from the starter to the motor should be connected to the *negative* terminal of the shunt on the motor, and not the positive.

Frank Powell.

Doncaster, *January 27th*, 1902.

In my letter on this subject, published in your issue of January 17th, I said:—"The statement made in hint No. 7, p. 9, is absolutely false, since with all shunt motors the efficiency increases with load up to a certain maximum, which will be usually found at or near full load."

I must now qualify the above paragraph, as follows:—

The statement made in hint No. 7, p. 9, is *not* absolutely false; for the author of that statement has, in reply to my letter, given us his definition of the word "efficiency," which occurs in hint No. 7, and various other places throughout his articles. By "*efficiency* of a motor" he means the ratio—

$$\frac{w}{W}, \text{ or } \frac{e\,C - C^2\,R}{e\,C}, \text{ or } \frac{E}{e},$$

using, as he says, the "ordinary forms."

From this statement it appears that in his "efficiency" calculations he takes into consideration only what is usually called the "electrical efficiency of the armature," thus neglecting entirely the $C^2\,R$ loss in the field, and not reckoning *as losses* the power absorbed in hysteresis, eddy currents, mechanical friction and windage. Further comment is needless, but the whole of the opening paragraphs on p. 1068, Vol. 49, will now be read in a new light, particularly the sentence:—"I have little hesitation in stating that *the efficiency* of that motor is nearer 88 per cent."

I did not take exception to the statement "the starter is not by any means intended to be a shunt breaker," but I did say, and still maintain, that the method of testing the shunt circuit given in the ELECTRICAL REVIEW of January 3rd is a very bad one.

The explanation of the effect of the laminated field is as follows:—If the field is *not* laminated, the energy which manifests itself in inductive effects when the field circuit is broken, will probably be largely dissipated in producing eddy currents in the field magnet itself.

I must ask the readers of the ELECTRICAL REVIEW to take my word for the truth of paragraph No. 4 in my former letter, as I am not at liberty at present to publish data of the motors whose insulation broke down.

Mr. White's semi-personal insinuations I prefer to disregard.

Wm. Cramp.

Central Technical College,
January 28th, 1902.

THE L.C.C. ELECTRIC TRAMWAYS.

THE London County Council had under consideration on Tuesday, the adjourned report of the Highways Committee, who recommended the Council to approve estimates of £644,350 for the reconstruction for electric traction of the tramways between (1) Kennington Road and St. George's Circus; (2) the Elephant and Castle and New Cross Gate; (3) the Elephant and Castle and St. George's Church, and thence to the junction of New and Old Kent Roads; (4) the Elephant and New Cross Gate *vid* Walworth Road and Camberwell Road; (5) Camberwell Green and Vauxhall Bridge; and (6) Kennington Park Road and Brixton Road.

The Finance Committee, in a report on the financial bearings of the scheme, stated that the proposed works consisted of the laying of 19¼ miles of single track. It was proposed to spread the repayment of £68,000 required for new buildings and bridge construction over the full period of 60 years, whilst the £576,350 for lines, machinery, and rolling stock would be distributed over 25 years. In considering these estimates, the Committee desired to compare them with the preliminary forecast of £15,000 a mile of single track which the Council has generally understood to be the approximate cost of converting the tramways for electric traction. It appeared that that figure included provision for cars, and the power to work them, at the rate of only 2½ cars for each mile of single track, whereas most of the London tramways were equipped with a much larger number of cars. Taking, however, the allowance adopted for the forecast, the cost per mile of single track of the lines now under consideration, worked out at about £18,000. The cost of the Tooting lines, on the same basis, and according to the tenders accepted for most of the works, amounted to £17,670 per mile. The excess of the estimates over the £15,000 was explained by the Highways Committee in the following manner: That the estimate of £15,000 applied to the whole of the existing tramways in London, that it was not limited to underground conduit as the only system to be adopted, and that, while Prof. Kennedy had anticipated that some portion of the lines would cost more than £15,000 per mile, he expected that other portions might be constructed at a lower cost. The estimates for the 19¼ miles had been prepared on the basis of the tenders received for the Tooting lines, and the Finance Committee thought it not unreasonable to expect that the work would be carried out within the estimates. The Committee proceeded to remark:—

As already stated, the allowance of 2½ cars per mile is insufficient. We are informed that at the present time the number of horse-cars on the Council's southern system is about 8 per mile, and the Highways Committee expect that a larger number will be required for electrical traction, notwithstanding the increased accommodation which each car will provide. The estimates now under consideration contain provision for 10 cars per mile and the corresponding power to work them. We understand, however, that the estimates include provision for more generating plant and car sheds than will be required for the working of the 19¼ miles of line now in question, but, on the other hand, they include nothing in respect of the proposed generating station buildings at Greenwich, which will be the subject of a separate vote. The Highways Committee inform us that on the basis of these estimates the cost of this section works out to between £32,000 and £33,000 per mile of single track fully equipped.

Although the increase in the number of cars will doubtless be accompanied by better returns, it adds largely to the capital commitments of the Council. The cost of conversion of the southern system (about 47 miles of single line) being now estimated at approximately £1,500,000, it is obvious that the conversion of all the existing 200 miles of London tramways, as they come into the possession of the Council, will cost considerably more than the sum of £3,000,000 (calculated as 200 miles of single line at £15,000 a mile), which was inserted as the Parliamentary estimate in the London County Tramways (Electrical Power) Act, 1900, even though so large a number of cars per mile may not be required elsewhere as on the Council's southern system. In addition to this heavy outlay during the next few years on the conversion of existing lines, the new lines for which power has been obtained, or is being sought, are estimated to cost about £1,365,000, exclusive of the proportion of the estimated cost of street widenings to be charged to the tramways account, amounting to about £241,000.

As to the financial results expected to follow the conversion of the 19¼ miles under consideration, the Finance Committee stated that the car mileage on these lines was at present over 4,700,000 miles per annum. Continuing, the Committee observed:—

During the year 1900—1 the average receipts for the southern system amounted to 10·68d. per car-mile, and the average expenses were 9·23d. leaving a profit on working of 1·45d. per car-mile. The year, however, was one in which expenses were abnormally heavy, and it would perhaps be fairer to take the figure of 2d. a mile as representing the profit on working under more normal conditions. Out of this 2d., interest and sinking fund charges on the existing debt, amounting to a little over 1d. a mile, have to be paid. When the lines are converted to electrical traction the carrying capacity of each car will be increased by about 50 per cent., and, having regard to the popularity of electrical tramways and to the fact that the existing horse-cars are frequently crowded, it is expected by the Highways Committee that the receipts per mile will average at least 1s. The Committee also estimate that the working expenses will not exceed 6d. per mile, including the whole cost of the provision of power, i.e., not only the cost of maintaining and working the generating plant, but also the charge for interest on and repayment of capital outlay on the generating station, mains, &c., required for the supply of power. We understand that this estimate includes provision for a renewals reserve fund, and we are strongly of opinion that a sufficient reserve fund should be provided. The estimates of receipts and working expenses are, we understand, fully supported by the experience of other undertakings. We therefore assume that the Council will earn a profit on electrical working of 6d. per mile run instead of 2d. per mile on horse traction, or an increase of profit of about 4d. per mile for the 4,700,000 miles per annum at present run, or £78,333 a year. But in addition to this the Highways Committee anticipate that, owing to the increased speed at which the cars will travel and to the popularity of the system, the traffic will increase, and they consider it quite safe to estimate for an increased car mileage of 1,000,000 per annum. This estimate also is supported by the experience of other similar undertakings. On this extra mileage there would be an additional profit (at 6d. per mile) of £25,000, making a total estimated increase in the profit on working of, say, £103,000. Out of this will have to be paid interest and sinking fund charges on the cost of conversion, which, excluding items relating to the supply of power (covered by the 6d. a mile estimate for working expenses) amounts to £573,500. Interest on this sum at 3½ per cent. would be £18,640, and the annual charge for repayment (£68,000 in 59 years and the balance in 25 years) would be £21,573, making together £40,031, which, however, would decrease as the debt is paid off. Thus it is evident that the result of conversion should be advantageous financially.

After suggesting that everything should be done to reduce the period of reconstruction, the Finance Committee remarked that the term of 25 years for repayment of expenditure on machinery and rolling stock was a liberal one, and it would be to the ultimate advantage of the tramway undertaking if the debt could be paid off more rapidly. In conclusion, the Committee stated they were impressed with the magnitude of the expenditure involved, and the necessity for caution in regard to these large proposals for conversions and extensions of the tramway system.

The report and its recommendations were adopted after lengthy discussion.

BUSINESS NOTES.

Electrical Wares Exported.

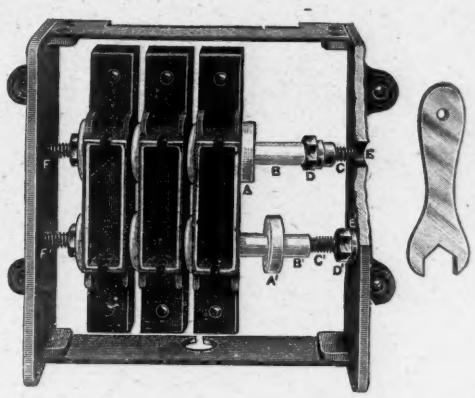
WEEK ENDING JAN. 29TH, 1901.		WEEK ENDING JAN. 28TH, 1902	
Alexandria	Value £15	Alexandria	Value £78
Amsterdam	115	Beira	464
Bahia. Teleg. apparatus ..	139	Brisbane	453
Brisbane	46	Calcutta	2,050
Calcutta	1,826	Cape Town	2,897
,, Teleg. wire	184	Channel Islands	10
Cape Town	153	Colombo. Teleg. mat.	186
Copenhagen. Teleg. wire ..	207	Copenhagen	13
Delagoa Bay. Teleg. cable ..	130	,, Teleg. wire ..	79
Durban	707	Demerara	47
Fremantle	40	Durban	1,400
Gibraltar	43	East London	10
Hamburg	80	Gothenburg	25
,, Teleg. mat... ..	800	Grenada. Teleg. mat.	40
Hobart	107	Hamburg	51
Hong Kong	23	Hong Kong	742
Malta	15	,, Teleg. wire ..	68
Nagasaki. Teleg. cable	2,200	Lyttleton	50
Ostend	531	Melbourne	630
Perth. Elecl. tramway plant ..	4,000	,, Teleg. wire	2,281
Port Elizabeth	43	Port Elizabeth	1,093
Shanghai	88	Rangoon	17
Sydney	1,756	Shanghai	220
Trinidad	77	Singapore. Teleg. mat. ..	99
		Sydney	1,674
		Wellington	39
		Yokohama	466
Total ..	£13,275	Total ..	£15,192

Foreign Goods Transhipped.

Sydney. Elec. goods .. Value £852 |

Acetylene Association.—Mr. L. Downes, secretary *pro tem.* of the new Acetylene Association (11, Ironmonger Lane, Cheapside, E.C.), has placed before us a copy of the memorandum and articles of association, with the list of the original honorary members and original members of the Council. From these documents a general idea of the constitution and aims of the Association may be obtained. The Association has been formed for the advancement of acetylene gas engineering and manufacture in the interests of the public and of the industry.

Ashton H.V. Distribution Boards.—We illustrate below the "Ashton" high-voltage distribution boards, which are supplied by Veritys, Limited. The ends of the cases are of substantial cast-iron, while the sides and lid are of sheet-steel. The latter is vitreous-enamelled. When fixed on a flat wall, a sheet of asbestos, laid on the wall before screwing the case up, forms the best back, or, again, a sheet of iron may be screwed up between the case and the wall. Each of the china fuse slabs is provided with two ¼-in. holes, passing laterally through it. Two ¼-in. iron iron rods, C, C′, screwed their whole length, and covered with sleeves of rubber tube, B, B′, except at their ends (which are left bare for the nuts), pass through these holes in the chinas. The latter are thus strung together on the rubber-covered rods, and are clamped up by nuts outside the two end pots. Rubber washers, A, A′, are inserted on the rods between every slab, so that the china is virtually hung on rubber. The method of securing the slabs into their iron case should be noted. The slabs are clamped together as described, forming one rigid piece. The two ends, F, F′, of the ¼-in. rods are left conical, and are inserted into two ¼-in. holes, drilled in one end of the case. The doubled-shouldered nuts, D, D′, are then



screwed outwards, until their smaller shoulders enter the holes E, E′ in the other end of the case. In the sketch the nut D′ is screwed tight up to the case, and D is in the loose position. By tightening these nuts against the case, the two rods, and consequently the fuseways carried by them, are held firmly and securely. We understand that there is a demand for these boards where a high degree of insulation resistance is required.

Bankruptcy Proceedings.—Creditors of H. D. Barclay, electrical engineer and contractor, of South Hampstead, Oxford Street, W., and Manchester, must send particulars of claims, &c., to Mr. G. White, 14, Old Jewry Chambers, E.C., the trustee under a deed of assignment executed in June, 1899.

Dissolutions and Liquidations.—The Leecoll Electric Battery Company is winding up voluntarily, with Mr. S. A. Cobbett, of 14, Devonshire Square, E.C., as liquidator.

The British Electrical Manufacturing Company is winding up voluntarily, with Mr. J. E. Ward, 122, Cannon Street, as liquidator.

Messrs. C. A. Robinson & H. V. Sadler (Robinson, Sadler & Co.), electrical and mechanical engineers, of Plymouth, have dissolved partnership.

In the Chancery Court of Lancashire, on 20th inst., at Manchester before Vice-Chancellor Hall, a petition was presented by J. E. Stott, electrical engineer, in the matter of the Electrical Regulating and Lighting Syndicate, Limited, of Liverpool. Last November his Honour made the usual compulsory order, but directed that it should not be drawn up till the following Wednesday, in order to give the syndicate time to pay. They did not pay, but the plaintiff having waited longer than was directed, a difficulty arose in drawing up the order. The Vice-Chancellor directed that the order should be drawn up as from that day.

Books Received.—"Transactions of the American Society of Mechanical Engineers," Vol. xxii. 1901. New York Published by the Society.

"Signaux Télégraphiques Adaptés au Noveau Langage Convenu, by James Nicholson. Glasgow: William Asher. Buenos Ayres J. H. Kidd & Co. 1901. 6 fr.

"Science Abstracts," No. 49, January 25th, and Index to Vol. iv., 1901. London: E. & F. N. Spon, Limited. 2s. each.

"An Elementary Treatise on Alternating Currents," by W. G. Rhodes. London: Longmans, Green & Co. 1902. 7s. 6d. net.

Burst Fly-wheel.—The "explosion" at the works of Messrs. Hurst, Nelson & Co.'s works, to which reference was made last week, seems to have been the bursting of an engine fly-wheel of 14 ft. diameter. The engine was driving a dynamo at the time of the accident.

Catalogues and Lists.—The International Acheson Graphite Company, of Niagara Falls, have sent us one of their very neatly gotten-up lists of graphite electrodes for use in electrolytic and electro-metallurgical processes.

A new illustrated circular, dated January, 1902, has been issued by Messrs. Holden & Brooke, in which the various patterns of their injectors are shown.

Messrs. Gent & Co., of Leicester, have sent us a set of their revised sheets of patent watchman's clocks or electric tell-tales. Their dry-ink-marking tell-tale clocks of standard pattern with single and twin cylinders, are illustrated with and without cabinets, and the parts of their contact boxes are also shown. A list of some of the principal public buildings, factories, warehouses, &c., where their tell-tale clocks are working is shown. Messrs. Gent's lists of water-level indicators were also placed before us. These give particulars of their indicators for asylums, hospitals, and large institutions, the various parts of an installation being very well

shown. In their apparatus the driving spindle is taken out in a long sleeve and stuffing box, and the case being metal throughout, the apparatus is not only damp-proof, but also water-tight. Messrs. Gent are at present making a large number of these instruments for corporation reservoirs, breweries, artesian wells, and impounding tanks. The prime consideration in design has been reliability and strength. The reliability of the transmitter end is largely due to the apparatus being hermetically sealed.

The Electrical Company, Limited, send us a price list of Nernst and other lamps. The former are for pressures between 100 and 250 volts, and candle-powers from 60 to 168; they are of the automatic type, and will no doubt excite much interest.

The Glasgow Switchboard Accident.—A fatal accident inquiry has been held before Sheriff Scott Moncrieff, relating to the death of Robert Stannage, 21, a labourer, at Pinkston Power Station, last November. Mr. Field, the electrical engineer, stated that the deceased was working behind the switchboard, on a ladder, when the accident happened. While witness was going through the station on the morning in question, he heard a shout and noticed a flash. He immediately went to the switchboard gallery to see what was wrong, but on account of the flashes, he could not distinguish what was happening. He noticed deceased reel and fall from the ladder. His explanation was that the man's head must have come in contact with the 6,500-volt bus bars, and the current passed to earth through his hands. The ladder rested against an iron beam supporting the switchgear. Similar evidence having been given, a verdict in accordance with it was given.

Garcke's Manual.—If there is one book which the electrical engineer finds more necessary than another, it is "The Manual of Electrical Undertakings," which has now been so ably produced under Mr. E. Garcke's supervision during the past six years. When we say electrical engineer, we speak generally, and, of course, include everyone who wishes to have at hand just that collection of financial, commercial, and engineering detail which will enable him to keep himself well posted in regard to the various branches of the electrical engineering industries. We need not go into detail in regard to the contents, but we may remark that the 1901—1902 edition has been rearranged and enlarged in size. The information is classified under five sections: (1) Electric lighting, traction, and power; (2) telegraph and telephone; (3) manufacturing and miscellaneous; (4) directory of officials; (5) lists of electrical companies registered since 1856. The particulars are given relating to upwards of 1,500 electrical undertakings owned by companies and municipalities. We learn that the aggregate capital issued by companies in shares, debentures and loans, and amounts borrowed by municipalities for electrical undertakings is now £165,807,474. By means of coloured diagrams, the comparative results of working of all electricity supply undertakings in operation are shown; other important items being a map of the 217 miles of electric railways of London, and nine maps of the areas of electrical power schemes. This valuable work needs no further recommendation from us. It is published at Mowbray House, Norfolk Street, W.C. (12s. 6d. net).

Plant for Sale.—The Glasgow Corporation Electricity Department is advertising for sale various sets of combined plant now at Waterloo Street; they are Willans-Siemens, Willans-Latimer Clark, Willans-Goolden, and there are 15 sets in all. See our "Official Notices" to-day for details.

The Schmidt System.—Messrs. Easton & Co., Limited, have granted sub-licenses to:—Messrs. Fairbairn, Lawson, Combe, Barbour, Limited (Combe-Barbour Branch), Belfast; Messrs. Bow, MacLachlan & Co., Limited, Paisley; Messrs. J. Carmichael & Co., Limited, Dundee, to construct engines to work with highly superheated steam on the Schmidt system, Messrs. Easton retaining the sole right to manufacture the superheaters required in connection with such engines.

Single-Phase Motors at West Ham.—The order for the conversion of the workshops belonging to the Works Department of the West Ham Corporation, from steam to electric driving, has been placed with Messrs. Witting Bros., Electrical Engineers and Contractors, Limited. The existing engines and countershafting will be removed and replaced by single-phase Heyland motors, operating at 50 cycles and 200 volts, and all being capable of starting with full load torque, if necessary. There will be two motors of 5-B.H.P., two of 4-B.H.P., five of 2-B.H.P., one of 1-B.H.P., two of ½-B.H.P., and one large motor whose output is not yet definitely settled. Messrs. Witting Bros. some time ago completed a similar installation for the Corporation, namely, the conversion of the chaff-cutting and similar machines used at the large stables of the Corporation from gas engines to electric driving. It is, in fact, the success of this installation that has led to the adoption of electric driving for the above-mentioned workshops. The Heyland motors at the stables include one of 7-B.H.P., one of 5-B.H.P., one of 2½-B.H.P., and two of 1-B.H.P. The West Ham Corporation supply a large amount of single-phase current for motive-power purposes in their area, and most of the motors in this district are of the Heyland single-phase type, all being capable of starting with full load torque and a reasonable current consumption. One of the first motors Messrs. Witting Bros. put down in this district was one of 15-B.H.P. direct coupled to an Isler deep-well pump. The motor starts directly on the pump, there being no clutches or similar devices used, and no trouble whatever is experienced in operating the motor under these heavy conditions.

Trade Announcement.—Messrs. Duflon, Constantinovitch & Cie., of St. Petersburg, notify that, with a view to extending operations, they have formed themselves into a limited company, with the following title: Société de Constructions Electro-Mécaniques ci-devant Société "Duflon, Constantinovitch & Co." (capital 750,000 rbs). The works and offices at St. Petersburg are at Ile des Apothicaires, Rue Lapouchinskaïa, No. 8. The company also has branches at Moscow, Ekaterinebourg, and at Kharkoff.

ELECTRIC LIGHT AND POWER NOTES.

Alloa.—We understand that although the formal inauguration of the electricity supply took place on 16th inst., the public lighting was commenced on New Year's Eve, and the private consumers were connected on 10th inst. The British Electric Plant Company, Limited, gave a week's free supply of energy for a start.

Ashley.—The D.C. has approved of the Leicestershire and Warwickshire Power Company's scheme.

Belgium.—The Belgian State railway authorities are about to establish a central station at Marchienne au Point for the lighting of the railway station and goods yard.

Blackburn.—At the request of the Electricity Committee the President of the Institution of Civil Engineers, Mr. Hawksley, has nominated a member of the Institution to report on the tenders for new engines for the electricity works. The name of the engineer is not to be disclosed.

Bournemouth.—It was recently reported to the T.C. that the Bournemouth Electricity Supply Company were laying down mains in a suburb of the borough, notwithstanding the disapproval of the Council. The Town Clerk was instructed to write to the company to protest, and also to the B. of T. informing them that the works had only been begun since the notice of the Corporation's intention to apply for an order had been published and after the expiration of the two years' limit named in the order.

Bridgwater.—The Corporation's 1898 Electric Lighting Order has been revoked by the B. of T.

Brierfield.—The D.C. has resolved to apply for leave to borrow £10,110 for electricity supply purposes. It is, however, intended to spend only £3,000, and to purchase electricity in bulk from the Nelson T.C.

Cardiff.—Good progress is shown in the report of Mr. A. Ellis, borough electrical engineer, for the past year. The maximum load has increased 30 per cent., and the units generated 44 per cent., while the wages bill is only half per cent. higher.

Coventry.—The electrical engineer, Mr. J. A. Jeckell, has issued a circular to the electricity consumers and others announcing a reduction in the price of electrical energy from 6d. the first hour, and 3d. afterwards, to 6d. for the first hour, 3d. the second, and 1d. afterwards. The importance of this change to long-hour consumers is emphasised. The rebates are to be allowed each quarter, instead of, as at present, half-yearly. Energy for motive power is to be charged for at 1½d. per unit, and Mr. Jeckell points out that single-phase motors are widely and successfully used elsewhere.

The E.L. Committee has resolved to recommend opposition to the Leicestershire and Warwickshire Electric Power Bill.

Exeter.—The City Council has appointed Mr. Robert Hammond to examine and report on the specifications and conditions for the equipment of the new electricity works, and has resolved to apply for leave to borrow £70,000 for electric lighting purposes.

Greenock.—The total lamp connection at the end of 1901 was 28,256 of 8 C.P., an increase of 14,472. The output was 280,263 units, against 150,642 in 1900, but the difference is almost entirely accounted for by the traction supply. The 1900 report, however, applied to 55 weeks.

Hoylake.—The Hoylake and West Kirby D.C. has adopted a recommendation of the Electric Supply Committee, that the prepayment meter system be adopted for small houses, and that a uniform charge of 5d. a unit be made for electricity supplied on the system. An electrical exhibition is to be held at an early date in the Town Hall, Hoylake.

Italy.—Mr. Celestino Diglia, of Turin, has applied for the concession of a catchment of water on the Po, and at the same time on the Lenta, with a view to creating an electric power station for agricultural purposes. The derivation on the Po would be taken in the Oacino territory, while that on the Lenta would be taken 300 miles higher up and would necessitate the construction of a dam. The two sources may be capable of developing 2,400 effective H.P. The cost of the project is estimated at 550,000 lire.

A project is also on foot for the execution of a catchment scheme on the Gionenco River at a distance of one kilometre from Pescina, for the purpose of carrying out an electric lighting undertaking to cost 100,000 lire.

Kent.—A meeting of representatives of local authorities was held last week to consider the provisions of the Kent Electric Power Bill. It was decided to oppose the Bill.

Kingston-on-Thames.—The T.C. has decided to affix to each arc standard two incandescent lamps for burning after midnight, the total estimated cost being £200.

Lancaster.—The electrical engineer, Mr. W. A. Tester, has recommended that the pressure of supply be increased from 200 to 230 volts, and the Committee has endorsed this.

Liverpool.—The Electric Power and Lighting Committee has resolved to charge for energy, up to 3,000 units per quarter, 3¾d. per unit; above 3,000 units, 3d. per unit; the reduction to date from the end of the current quarter. The present price is 4d. per unit, net. Energy for motive power will continue at 2d. per unit up to 3,000 units and 1½d. per unit afterwards.

The Committee had a surplus on the year's working of £24,000. It was decided to pass £7,500 of this to relief of rates, and to place the remainder to a renewal and repairs fund.

The city electrical engineer, Mr. A. B. Holmes, in submitting estimates for 1902 to the Electric Power and Lighting Committee, reports that the output of electrical energy during the past year has been more than 20 million units, and has, he believes, exceeded that of any other electrical undertaking in the United Kingdom. There has been a rapid growth of the supply from less than 3 million to over 20 million units during the past four years, and the number of tramcars now in service is more than 380, as against 250 at the commencement of the year.

London.—LONDON COUNTY COUNCIL.—The Council on Tuesday last week decided to sanction the borrowing by the Islington Borough Council of £8,420 for sinking a well, the purchase of transformers, and the extension of mains. It was decided to approve plans submitted by Mr. W. H. White, on behalf of the Metropolitan Electric Supply Company, for the erection of a building for the supply of electricity in North Street, Marylebone. It was stated by the Highways Committee that under each of the orders, with two exceptions, granted by the Board of Trade and confirmed by Parliament, the County Council is empowered to appoint "one or more competent and impartial person or persons to be electric inspectors" under the order. The duties to be discharged by the inspector were the inspection and testing of the undertakers' electric lines and works, and the supply of energy given by them, the examination and certifying of meters and such other duties as might be required of him under the provisions of the order or of any regulations under the order. The Council had already appointed inspectors, but the committee were advised that with a view to the inspectors being placed in a perfectly clear and satisfactory position, they should be appointed definitely under each Act or order. On the recommendation of the committee the Council resolved to appoint Messrs. T. P. Gunyon, A. E. Rossiter, H. W. Ridley, A. Champion and W. T. Hodgson to be electric inspectors under the Electric Lighting Acts and Orders, specified in a lengthy list submitted by the committee and covering both company and municipal undertakings.

The L.C.C. has written to the City Corporation referring to the refusal of certain electric lighting companies to amend their accounts in accordance with the report of the B. of T. auditor, the latter having pointed out that certain amounts ought not to have been charged to capital account. The L.C.C. drew the attention of the B. of T. to the importance of giving the auditor power to correct the accounts, in view of the possible purchase of the undertakings by municipalities. The B. of T., however, did not regard the matter as important.

BERMONDSEY.—On Thursday last week, the new refuse destructor and electricity works of the Bermondsey Borough Council were formally inaugurated. The municipality is in the uncommon position of having its Town Hall, public library, baths and washhouses, mortuary, destructor, electricity works, stables, and workshops, all massed together upon a single site. The present capacity of the generating plant, which consists of three Willans engines coupled to Thames Ironworks Company's dynamos, is 375 KW.; there is also a Tudor battery, balancer and charging motor-booster. The switchboard was constructed by Messrs. Crompton & Co., who also carried out the public arc lighting, and the boilers are of the Babcock and Wilcox type. Messrs. Hall & Co.'s differential feed pumps are used, with a Stanhope water softener. Messrs. W. T. Glover & Co. carried out the mains contracts. Messrs. Kincaid, Waller and Manville are the consulting engineers, and Mr. W. H. Vincent has been appointed borough electrical engineer. An electrical exhibition is to be held at the Town Hall on February 26th and 28th.

The opening ceremony took place in the Town Hall, which had been wired, and went off with great *éclat*. The Electricity Committee, in the *rôles* of shining lights, wore electric lamps in their buttonholes, which they switched on at the moment when the Mayor, Col. S. B. Bevington, switched on the lamps in the Town Hall, and an electric sign "Success to the Electricity Works."

The same evening a dinner was given by the engineers and contractors to the committee and others at the Trocadero, Mr. Manville presiding. The chairman of the Electric Lighting Committee, Mr. T. Cox, in toasting the "Houses of Parliament," referred to the legislation proposed to be carried through in the present Session, to extend the area of supply to the boundaries of the borough. In reply, Mr. H. Cust, M.P., emphasised the necessity of reform in procedure, especially in regard to carrying forward incompleted business from Session to Session, for lack of which Bermondsey had to obtain its powers twice over. Mr. H. B. Bird, chairman of the Shoreditch Electricity Committee, assisted by the town clerk, Mr. H. M. Robinson, endeavoured to prove that the £3,000 deficit on the accounts of that ill-fated undertaking, which we have had occasion to criticise from time to time, was really quite a different thing, and lamented that the committee had not raised the price of energy when the price of coal went up. Mr. Cox expressed the determination of the committee to go ahead, and make electricity the poor man's light—very truly urging that the pure air, which is unknown where gas is used, is more needed in crowded tenements than anywhere else. Mr. Henry Edmunds, proposing "The Guests" propounded the paradox that while the mains contractor's work was not only out of sight, but was a public nuisance while it was in progress, he hoped that when the mains were buried they would never be heard of again. Mr. Manville toasted "The Contractors," and pointed out that the responsibility for the success of an installation practically depends upon them. The speeches were interspersed with a pleasant programme of music, song, and story.

SOUTHWARK.—The Borough Council is to call a conference of London municipal electric lighting authorities, with a view to settling the charges to be made in connection with public electrical illumination at the Coronation.

CITY.—The Corporation is to be asked at its next meeting to appeal against the judgment that the remaining contract between it and the City of London Electric Lighting Company is valid.

ISLINGTON.—The L.C.C. has sanctioned loans to the B.C. of £8,420 for sinking a well and for extensions of mains, transformers, &c.

HACKNEY.—A remarkable run on the electricity works took place on 'Xmas eve. Explaining a partial breakdown on that day before the B.C. recently, the electrical engineer, Mr. L. L. Robinson, stated that apparently many consumers substituted lamps of twice the normal C.P., bringing the load up to 600 KW., double the anticipated demand. The breakdown was due to a faulty joint in the mains, which was flooded by a leak from the water mains. Some damage was caused to the generating plant, but was made good by the following morning.

Manchester.—An application of the T.C. for leave to borrow £447,000 for electricity supply purposes was yesterday to be inquired into on behalf of the L.G.B.

Nuneaton.—The U.D.C. is to apply for leave to borrow £5,000 for electricity supply purposes.

Shanghai.—The electricity works is fully loaded, and extensions of plant will be required at an early date.

Southampton.—The electrical engineer, Mr. H. F. Street, has reported to the Electricity Committee that extensions of the generating plant are urgently needed for next winter's load.

Stroud.—The R.D.C. has decided to oppose the Gloucestershire Electric Power Bill now being promoted in Parliament, the main ground of opposition being an objection to overhead wires.

Swansea.—On Saturday night last, owing to the presence of water in the electric lighting mains, the chief assistant engineer, Mr. Thompson, decided to open up some boxes in the streets. With the assistance of a foreman he lifted the cover of a main in Welcome Lane, near the lighting station, and lowered a lamp into the hole. Instantly there was an explosion, and the heavy covers of four manholes in two streets in the neighbourhood were blown up a height of about 20 ft. Mr. Thompson and his foreman were severely burnt, and a woman who was near was slightly injured. The explosion was due to an accumulation of gas in the boxes, caused, it was discovered, by a break in the gas main. A steam roller had been at work in the neighbourhood, and a water main and telephone main were also broken, it is presumed, by the same means.

The sub-committee of the E.L. Committee has instructed the engineer, Mr. Prussmann, to obtain tenders for two more engines of a collective capacity of 1,500 H.P., thus increasing the power of the station from 1,000 H.P. to 2,500 H.P.

During last year the amount expended on capital account was £50,510, and on revenue account £2,650. The number of applications for current is 182 with a total demand of 21,519 8-C.P. lamps.

Tottenham.—The U.D.C. has decided to oppose the North Metropolitan Electrical Power Supply Bill for extending the limits of supply to Tottenham, Edmonton, Enfield, Wood Green, and Southgate.

Wimbledon.—Mr. F. H. Tulloch, M.I.C.E., held a L.G.B. inquiry last Friday into an application of the U.D.C. for leave to borrow £18,500 for electric light extensions, £14,500 having been already spent in excess of loans authorised. There was no opposition.

Ystradgynlais.—A committee has been formed for the purpose of making arrangements for the supply of electric light for the town by next winter.

ELECTRIC TRACTION NOTES.

Aberdeen.—It is anticipated that the completion of the electrical equipment of the Union Street section will be completed early in March. The paviors who were working for Messrs. Macartney & McElroy in the reconstruction of the permanent way have been acting very blindly. They left the Corporation employ,

where they were paid 7½d. per hour, for that of the firm mentioned at 9d. per hour. They worked for a fortnight at that rate, but they seem to have got a notion that their services were indispensable, and they could get anything they asked for. Accordingly when the street was opened for a considerable distance they demanded 10d. per hour. This was refused, and the men threw down their tools. With the assistance of the tramways department, however, the company was able to get over the most pressing part of the difficulty. The men then saw that they had been worsted, and presented themselves at the Corporation yard for employment at their old rate of 7½d. To their surprise they found they were no longer needed there.

Australia.—It is reported in the *Frankfort Gazette* that Ganz & Co. have entered into an agreement with the Allgemeine Elektricitäts Gesellschaft, of Berlin, with a view to taking common action for the conversion to electric traction of several of the steam railways in Australia.

Bath.—A discussion took place last week at the City Council on the report of the Electric Traction Committee, which mentioned an application from the promoters for certain variations of routes. The Committee set forth the routes they preferred and those to which they objected, and their report was adopted.

The Baltimore & Ohio Bonds.—In our issue for December 13th (p. 1016), a reference was made to an article which recently appeared in the *Street Railway Journal* on the behaviour of copper bonds on the B. & O. Belt line. Mr. W. D. Young, the electrical engineer to that railroad, has written to our contemporary in regard to the matter, stating that the article was not an official statement of the conditions and results secured. He continues:—"The squeezing out of the bond strands was unquestionably due to the fact that the type of angle-bar used does not give sufficient clearance at the top between the inside of the angle-bar and the web of the rail, for the introduction of the bond. This trouble is further aggravated by the wearing of the angle-bar, which allows its surfaces to approach nearer and nearer to the web of the rail, thus forcing the upper strands of the bonds out by mechanical action. I believe that if greater space should be left between the angle-plate and the web of the rail, this difficulty would be entirely avoided. The section of rail to which these bonds have been applied is that used by the greater number of steam railroads, the rails and angle-bars being the standard established by the American Society of Civil Engineers, 100-lb. section, and in the design of this no consideration has been given to the matter of combining with these sections the necessary room for application of bonds. Inasmuch as the growing tendency is to more and more use in common for electrical traction, either wholly or in part, the existing steam railroad tracks, it seems very proper that the necessary modifications, as above outlined, should be seriously considered, and as this is purely a mechanical modification of the angle-bar, it can be easily overcome. I do not consider the type of bond at fault, and, so far as I know, if this change is made, the bond would be satisfactory. I wish to commend the manufacturers of the bond for the promptness with which they are taking up this problem with a view to making such changes as are necessary to meet the existing conditions."

Bournemouth.—The report containing a general description of the Corporation tramway scheme, signed by Alderman Lawson (chairman of the Tramways and Parliamentary Committee), and Mr. F. W. Lacey, borough engineer, was presented to the members of the Town Council last week. The average length of time lost in changing from the overhead to the conduit system is about 15 seconds. On the conduit system both positive and negative conductors are insulated from earth, these conductors being supplied with current by feeder cables from the conduit panels on the main switchboard at the generating station. The overhead line will be carried by insulated ears from bracket poles, two lines being provided throughout, one for the up and one for the down lines. The trolley lines will be supplied by feeder cables connected to the line at various points. All cables will be drawn into stoneware ducts, and section boxes provided with switches and fuses, erected at the feeding points and dividing up the overhead line into half-mile sections. Current for the overhead system will be supplied direct from the main generators in the station, and current for the conduit system will be supplied either from a motor-generator or from one of the main dynamos connected to the conduit feeders. It is proposed to light the main road by open type arc lamps, erected on the tramway poles. Current for these will be taken either from the motor-generator or from one of the main dynamos connected to the arc lighting switchboard. There will be four 30 ft. by 8 ft. 6 in. Lancashire boilers generating steam at a pressure of 180 lbs. per sq. in., superheated to a temperature of 500° F. The track rails will be steel girder rails, 100 lbs. to the yard, double-bonded at all joints with copper bonds, and cross-bonded every 100 yards, and at all points and crossings. The following cars are on order:—20 bogie cars to carry 30 persons inside and 32 outside; and 18 cars to carry 20 persons inside and 22 outside. The larger cars will be of an extreme length of 33 ft. 6 in., and of an inside length of 22 ft. 7 in., and of a width of 6 ft. 4 in. The smaller cars will be of an extreme length of 26 ft., and inside 15 ft. 2 in., and 6 ft. 4 in. wide. According to present arrangements the whole of the main road through the town from Pokesdown to the County Gates at Westbourne, as well as the Holdenhurst Road, will be paved throughout with wood block paving, except at points where the gradients are such as it is felt would be dangerous for wood block paving. Throughout these routes spaces between tracks will be wood block, but the other tracks will be macadamised in the centre with granite sett edging on either side of the rails. The cost is, of course, an important item in the scheme. Power was originally granted in 1900 to borrow £170,000 for the scheme been proposed, but this sum did not include the cost of street lighting, for which later on a loan of £12,441 was authorised. This estimate included 220 arc lights which it was originally proposed to place along the whole of the tramway routes, but in the specification now under consideration it is proposed to light the main roads as far as the Central Railway Station, which covers practically the compulsory area under the order, and will require from 140 to 150 lamps. The additional works authorised under the 1901 Act were estimated at £16,906 for permanent way only; and the cost of overhead equipment, cars and car-shed, plant, and proportion of cost of traction station is estimated at £20,000. The subsequent adoption of the conduit system through the centre of the town is estimated to cost an additional £15,000, and the works of wood-paving beyond that rendered necessary by the tramway, are expected to cost £37,000. Another extra since the original scheme was decided upon is £5,000 contemplated for extra conduits suggested by the Lighting Committee as a provision for the future. The whole of these items added to the original £170,000, brings the estimated total cost of the scheme up to £276,347. Tenders have not yet been accepted for coal bunkers and conveyers and ash conveyers; for switch gear; for motor-generator for conduit system; for station and car depôt lighting; for overhead equipment; for street lighting; or for tramway equipment and arc lighting cables. The lowest tender for the last-mentioned item is £20,669, and this, with the other tender, has been referred to the engineers. Rapid progress is being made with the works at the generating station and car-sheds.

Cast-Welding of Rail Joints.—During the past two or three years the Union Traction Company, of Philadelphia, has cast-welded over 5,000 old track joints, and 2,000 joints of new track. Much of the old track, says the *Street Railway Journal*, was too poor to be repaired with ordinary angle plates. Better results were found with 9-in. than with 4½-in., or other shallower rail sections. To carry out the work, the company have mounted the whole apparatus on a motor-driven platform with a large sheet asbestos shield to protect the trolley wires from the heat rising out of the cupola. The cupola has a diameter of 22 in., and will melt 6,000 to 7,000 lbs. of iron at a run. It is blown by a 5-H.P. blower, and is hinged to the car platform so that it can be kept level on grades. A joint can be run over only a few minutes after casting. It is said, however, that the company is not now casting any more joints, but is carrying on experiments with a "zinc joint." The Union Company does so much of its own work, that it has developed quite a number of special appliances to facilitate progress; these include a truck to carry rails, a truck to carry a rail punch, stands with poles to draw lighting current at night, and an emery wheel, driven through a Stow shaft by a motor for grinding cast rail joints.

Exeter.—The City Council has decided to apply to the L.G.B. for power to borrow £70,000 for a new power station for the electric lighting of the city and the proposed electric tram system. A deputation of six members is to visit various towns to inspect all methods of transit, trams or 'buses, electric or otherwise. The Bill now before the House of Commons, promoted by the tramway company, is to be opposed by the Corporation.

Gloucester.—A large meeting of the Gloucester Traders' Association recently passed a resolution recognising the great importance of the establishment of electric trams in Gloucester, and urging the Corporation to conclude the negotiations for the purchase of the tramways and plant at the sum provisionally agreed to, and to proceed with the conversion to electric traction as soon as possible.

The Great Eastern Railway and Electric Traction.—Speaking on Tuesday at the half-yearly meeting of the Great Eastern Railway, Lord Claud Hamilton, the chairman, said the shareholders would remember that some time ago he referred to the necessity which the directors felt of providing additional accommodation for their suburban traffic. Owing to the great cost of working high-level lines, the board had come to no definite decision, and they were inclined to favour a newer form of tube lines under their existing routes, but he told them last year that owing to the great uncertainty which prevailed as to the cost of construction and the profit likely to be obtained from those lines, he hoped the Government would suspend all Bills for the construction of that class of railway for a year and send them to a Joint Committee of both Houses of Parliament, which might report as to the manner in which London could best be served. The Government took that course, and all those lines had been suspended for the space of 12 months. During that time he and the board had had ample opportunity of considering that very important subject, and in doing so they had not lost sight of the new conditions which had to be faced by railway companies. It was no use their bewailing those new conditions, and giving them as an excuse for the falling off in dividends and then going on in the old way. What they had to do, like sensible men, was to look facts in the face and to acknowledge that those new conditions had come to stay. What were those new conditions? First of all increased obligations placed upon them by the Board of Trade acting under Parliamentary pressure; shorter hours of labour; higher wages; increasing assessments and higher rates, due to newly-elected bodies, and persistent demands on the part of the L.C.C. to compel them to carry certain classes of the community at unremunerative fares, and at inconvenient hours; and lastly, though not least, the construction by public bodies, at the cost of the rates, of tramways and electric railways, which would compete with the existing railways. In order to see what their position was, his Lordship said he had had taken out the figures of the

average amount they had received per passenger for the last two years, and he found that it was a slightly decreasing quantity. Taking the year 1901, the average first-class passenger receipts were 11·4d.; the second-class 5·13d.; third-class 4·44d., which gave them an average of 4·78d., or, roughly speaking, 4¾d. for every passenger. They carried during that period 118,906,000 people, producing £2,370,427, and it was evident that they must resist any further demands to compel them to carry certain classes of the community at lower fares. The question that the directors had been asking themselves during the past year was whether they would be justified in asking the shareholders, under the circumstances, to find further capital for the purpose of new suburban railways, and they had come to the conclusion that in their interests they ought to reconsider their position with regard to the public. They were now of opinion that for the present, at least, they should simply sit tight and watch events, and do all they could to consolidate and develop their existing resources. They were very closely watching every new development in regard to electric traction, but it was too early for them to arrive at any decision on the subject, or to give the shareholders any indication of what their ultimate views might be.

Houghton-le-Spring.—The United Kingdom Tramway, Light Railway, and Electrical Syndicate, which, 18 months ago, obtained powers for the construction of tramways in the Houghton-le-Spring district of the County of Durham, are seeking to have the time within which they must have the works completed extended for a period not exceeding 12 months. The syndicate have addressed a circular letter to the various Councils through whose districts the tramways will pass, explaining how the delay has arisen. They mention that there are 18 Councils interested in the scheme. The delay has chiefly arisen through the difficulty which has been experienced in getting the land necessary for the road improvements which the Board of Trade insists must be made along the course of the tramways. There are to be 20 miles of tramways, which will tap one of the largest mining centres in the county. It has been found also necessary to alter the gauge from 3 ft. 6 in. to 4 ft. 8 in., the same as the Sunderland Corporation Tramways, over which the syndicate hope ultimately to have running powers. Active steps are now being taken to promote the company, which is to be known as the Sunderland District and Houghton-le-Spring Electric Tramways Company. A good deal of preliminary work has been done.

Isle of Man.—The liquidator of the Isle of Man Tramways and Electric Power Company has sold the electric sections of the undertaking—Douglas to Ramsey and Laxey to Snaefell—for £252,000. The purchaser is Mr. Schenk, the chairman of the Crystal Palace Company. It is stated in the daily Press that for this sale, and the sale of the Douglas Tramways to the Corporation of that borough for £50,000, the liquidator, Mr. Walker, has obtained £73,500 more than was first offered at the public tender for the assets of the late company. This will enable the liquidator to pay a third dividend of 2s. to the Dumbell's Bank shareholders, who are creditors of the tramways for £85,000. After discharging the tramway debentures sufficient money will remain to pay the ordinary creditors 10s. in the pound.

Lancaster.—At the meeting of the T.C. on Wednesday the minutes of the Electric Tramways Committee showed that the tenders for platelaying and bonding of Messrs. E. Nicholls & Son, of Morecambe, has been accepted by the Corporation, the rails to be supplied by the Town Council, who will purchase them from the Leeds Steel Works. It has been decided to increase the size of the car shed in Dalton Square to 180 ft. instead of 100 ft., the contractors being Mr. W. Harrison (builder) and Messrs. Morton & Co., Limited, for the shed. After visiting Manchester and inspecting the cars in use there, the Committee have resolved to purchase three additional cars—10 in all—from the British Westinghouse Company, the bodies of the cars to be made by the Lancaster Railway Carriage and Wagon Company. The use of Newall's patent magnetic brakes on cars is under consideration.

Lees.—The promoters of the Saddleworth, Springhead, and Lees Electric Tramway scheme have struck Lees out of the Bill.

Levenshulme.—The negotiations between the U.D.C. and the Manchester Corporation have now so far progressed that the first-named body has decided to apply to the B. of T. for sanction to borrow £8,063 for the reconstruction of tramways.

Liverpool.—At a recent meeting of the Tramways Committee, statistics of the working of the tramways for the past five years were submitted by the general manager, Mr. C. R. Bellamy. The returns for the years 1897—1901 were as follow:—

Year.	Mileage.	Passengers.	Receipts.	Inc. in traffic receipts.
1897	6,013,180	88,409,084	£290,743	—
1898	6,279,758	41,772,034	314,207	£23,464
1899	7,600,546	63,771,450	359,929	45,722
1900	9,100,866	82,367,958	417,574	57,645
1901	10,970,063	101,108,790	468,383	50,809

The percentages of increase in 1901, compared with 1897 and 1900, were:—

	On 1897.	On 1900.
Passengers	163·3 per cent.	22·7 per cent.
Mileage	82·4 „	20·5 „
Receipts..	61·1 „	12·2 „

The year 1907 was the last year in which the old Liverpool Tramways Company had control of the service.

The profits on the Corporation tramways service for 1901 were upwards of £52,000. The Tramways Committee have decided to place two-thirds of the surplus to a renewal fund, and to hand over the balance of £17,000 to £18,000 to the relief of the city rates. A special Act of Parliament will have to be obtained authorising this.

At the fortnightly meeting of the Liverpool Tramways Committee, the chairman, Mr. E. L. Lloyd, referred to the fall recently of an iron girder on the overhead wires in Dale Street. The fall of the girder, he said, had subjected the overhead equipment to a test, the severity of which he hoped would dwell in the memory of the public. The overhead wire was of the very hardest drawn copper, and its strength was manifest. The pole strap, eye bolt, and another part of the equipment were before the Committee, and the members would see that, after two years' use, the whole thing was in as good condition as when put up. Mr. C. R. Bellamy informed the Committee that the weight of the girder which fell was stated to be 4 tons.

London.—At last week's L.C.C. meeting, the report of the Highways Committee reminded the Council that the directors of the South-Eastern Metropolitan Tramways Company were disposed to advise the shareholders to sell their undertaking to the Council for £50,000. It appears that the tramways, which are about 2½ miles in length, would not in the ordinary course become purchasable until 1909. The lines start within a few yards of the Council's tramways in Greenwich Road, and their route is along South Street, Greenwich; Lewisham Road; and High Street, Lewisham, to the terminus at Rushey Green, and it would be obvious that they could easily, by means of a short junction, be made to form part of the Council's system. As the company did not own any horses, the Committee proposed to report at a later date on the arrangements for horsing the cars, pending the reconstruction of the lines for electric traction, and they recommended the Council to enter into an agreement for the purchase of the company's lines. In a separate report by the Finance Committee, it was submitted that a considerable portion of the sum of £50,000 must be taken as representing payment for the goodwill of the undertaking as the lines could be compulsorily acquired in 1909, and that the repayment of the expenditure might be spread over a period of 25 years as proposed by the Highways Committee. The recommendation of the latter Committee was unanimously adopted.

Mr. W. Bruce asked the chairman of the Highways Committee whether he could inform the Council of the progress made with the negotiations with the North Metropolitan Tramways Company as to the electrification of the tramway system in the North and North-east of London, and whether the Committee would consider the expediency of obtaining a temporary supply of current from the local authorities which have generating stations. Mr. J. W. Benn, in reply, said the Council had given notice to the company that it was proposed to enforce the clauses contained in the lease with regard to electrification of the system at the earliest moment, and had invited the company to inform the Council the most convenient way for the company for the proper execution of the project. With regard to obtaining power from the borough councils, that was rather a difficult question. The Council could hardly pick up its power as it passed through various districts. It would be necessary to have a supply from one or two generating stations at least, but if Mr. Bruce would direct the Committee to any generating stations they would doubtless be prepared to avail themselves of the service.

In the King's Bench on Monday, before Mr. Justice Darling, Mr. A. R. Bulley, a builder, also obtained £100 damages against the L.U.T. Co. for personal injuries and damage to pony and trap, sustained through negligence on the part of defendants in April last year.

In the King's Bench Division on Friday last, before Mr. Justice Bruce and a special jury, the case of Meulemin *v.* London United Tramways Company, Limited, was heard. Plaintiff, wife of a coachman, claimed for personal injuries caused through the alleged negligence of defendants' servants, when a collision occurred between a jaunting car in which she was riding and a car of the L.U.T. The jury awarded £200 damages.

Loughborough.—The Loughborough and District Light Railway Syndicate have asked the Loughborough T.C. to transfer their electrical powers to them for 21 years. At the next meeting of the T.C. the General Purposes Committee, who have had under consideration the syndicate's proposals, will propose that the Council rescind their resolution of December 2nd as to the exercise of the electrical powers of the Corporation, and that, in the event of the Council adopting that recommendation, a committee be appointed to negotiate with the Light Railway Syndicate with a view to arranging terms for the transference of the electrical powers of the Corporation to the syndicate.

Maidenhead.—The D.C. has resolved to apply for light railway powers in May. The borough surveyor is to prepare plans, estimates, &c., for a railway, and to oppose the application of the M.D.E.T. Company.

New York.—The New York Central authorities have entered into a contract with the New York Edison Company for the installation and current supply of arc lamps for lighting the central tunnel. Nothing definite appears yet to have been decided upon with respect to the electrical equipment of the tunnel, though the newspapers daily make statements to the contrary, the non-authoritative nature of which is indicated by their conflicting character.—*Electrical World.*

Paris.—It is stated that on Wednesday night last week a train on the underground electric railway here caught fire between two of the stations. It seems that a short-circuit in one of the motors under the leading carriage was responsible for the affair. We gather that the service was interrupted for a couple of hours in consequence.

The Lye.—The electric tramline which Mr. G. Law is now constructing, is well in hand, and it is to be completed in six months. It will cover a distance of two miles of the old coach road from Stourbridge to Birmingham, and be a link to which, no doubt in time, other links will be joined ultimately connecting Birmingham and Stourbridge.

Romford.—A poll of ratepayers, in regard to the proposed municipal tramway scheme, shows that it is rejected by a majority of 623 votes. The voting papers sent in numbered 1,966, and of these 471 were blank.

Stroud. — On Saturday a conference was held at Gloucester between representatives of the Stroud Urban Council and the members of the Highways Committee of the County Council with reference to the scheme of electric trams for the Stroud district, proposed to be carried out by Messrs. T. Nevins & Son. The proceedings were conducted *in camera*, but it is satisfactory to learn that an agreement was arrived at which will allow of the tramways being laid as soon as the necessary formalities have been complied with.

Sunderland.—The first report of the municipal tramways has just been issued to the members of the Tramways Committee. It covers the period from January 1st, 1900, to September 30th, 1901—21 months in all. The report is of an exhaustive nature, and outlines the scheme from its inception; it gives details of the lines for which powers to construct have been obtained, most of which have been already executed, the exceptions being:—A line to Fulwell, 3·46 miles; and the High Street East route 1·61 miles. When these extensions are carried out, the system will consist of 23·13 miles of single track. The inclusive cost per mile is £7,270. The net profit for the 15 months since the taking over of the trams from the private company, to March 31st (during which time the one track was taken up and the other substituted), was £4,757, which includes receipts both from horse and electric traction, and the passengers numbered about 6¼ millions. For the next six months, however, the profit was almost doubled, being £9,829 (although the period was only two-fifths of the former), and the number of passengers had increased from 6¼ millions in 15 months to about seven millions in six months. The net profits for the 21 months were £14,500, and this is regarded as extremely satisfactory. The gross profits for the last half-year were £16,440, representing above 8 per cent. on the then capital of £202,033.

Sydney (N.S.W.).—The electric tramlines have been opened for traffic in Pitt and Castlereagh Streets. The lines, says the *British Australasian*, are now along the four main arteries of the city.

Underground Railways.—In the House of Commons last week Mr. G. Balfour informed Mr. M'Laren that his attention had been directed to the number of new Bills deposited for the construction of underground tube railways in London, and he was considering the question of referring these Bills, as last year, to a committee, who would have regard to the public convenience in the selection of routes.

The promoters do not intend to proceed further with the Brompton and Piccadilly Circus Railway Bill, and the Central London Railway (No. 1) Bill, two of the measures which were suspended from the session of 1901. The latter proposed the construction of a loop at the City end, and is superseded by the larger "circle" proposal.

It is announced that the Manchester tube railway scheme has been abandoned.

Weston-super-Mare.—The work of laying the tramways has been commenced, and it is stated that the greater portion of the line will be ready for opening early in April.

Wimbledon.—A canvass of the frontagers affected by the L.U.T. proposals in Broadway, Merton Road, and Merton High Street shows that 75 per cent. are against the scheme, most of the remainder being apathetic.

Woodford.—The D.C. will oppose the Walthamstow Council's light railway scheme, so far as it affects Woodford.

TELEGRAPH AND TELEPHONE NOTES.

Abyssinian Telegraphs.—The Paris correspondent of the *Times* quotes the *Journal de Djibouti* to the effect that the Negus has given instructions for the rapid completion of the telegraphic and telephone lines between the Italian colony of Eritrea and his capital. The telephone is in great demand between Addis Abeba and Harar. When first put up the wires were frequently cut by mischief makers, but the Emperor published a proclamation stating that anyone who cut a wire would have his hand cut off, and that the district where the injury was done would be condemned to pay a heavy fine.

American Pacific Cable.—Reuter's correspondent at Washington stated on 28th inst. that the Committee on Commerce in the House of Representatives had decided in favour of the construction, operation and maintenance by the Government of the Pacific cable, and had ordered a favourable report to be made on the Bill for that purpose. The Committee amended the Bill so as to provide that the cable shall be of American make, if it can be supplied according to the highest standard and at a cost not exceeding 10 per cent. above that of foreign manufacture. Arrangements for connections with Japan and China are authorised. As finally determined upon, the Bill provides for a Government cable between California, Hawaii and the Philippines *vid* the Midway and Guam Islands, or whatever route the President may consider most practicable. The cost is not to exceed $10,000,000, and the work of construction will be entrusted to the Army and Navy Department. Provision is made for Government messages and also for private messages at a rate not exceeding 25 cents a word to Hawaii and 50 cents to Manila.

Hull Telephones.—The Hull Parliamentary Committee will oppose the National Telephone Company's Bill, in which the company asked that, in the event of the Corporation obtaining a license from the Postmaster-General to establish a telephonic communication within the city, the powers of the company, which they had acquired for the purpose of laying down underground wires, should continue, and the provisions of Sec. 3 of the Telegraph Act, 1899, should apply.

Manchester Telephones.—A conference of the representatives of the authorities in the Manchester telephone area has unanimously decided to oppose the National Telephone Company's Bill.

Persian Gulf.—It is reported from Constantinople that Great Britain intends to obtain permission from the Porte to erect a telegraph line through Turkish territory from Koweyt to Fao in the Persian Gulf, where an English telegraph station already exists.

Scarborough Telephones.—The Municipal Telephone Sub-Committee having consulted Mr. A. R. Bennett on the question of a telephone license, has written to the Postmaster-General for a map of the local telephone area, and the engineer is to prepare certain plans.

Swansea Telephones.—The Telephone Committee of the Corporation last week had before it Mr. A. R. Bennett's report on municipal telephones. He estimated the revenue at £4,301 and the working expenses at £3,566. The committee decided to recommend the Council to apply for a license, and to raise a loan; also that the tariff be £5 per annum for an unlimited service, or £3 and 1d. per call. In his report Mr. Bennett says:—"It is evident that in your area there has been a mere scratching of the surface of the telephonic field and no more. But this is a fact which will require to assert itself gradually, and to begin with, I do not propose to provide for more than 1,500 lines, including 50 public telephones—that is to say, about double the present number of lines. Of these, again, I would provide for the immediate complete finishing of only one-half, say, 750 lines, including 25 public telephones; for the other half, ducts would be laid and provision made as regards space in switch-rooms, designs of switchboards, spare room on poles, &c." The capital expenditure Mr. Bennett estimates at £18,000, the estimated revenue from 725 subscribers and public telephones, &c., at £4,301, and the cost of working expenses and interest and sinking fund, £3,566, leaving a net revenue of £735 per annum, to be added to which would be £150 a year now paid to the National Telephone Company. Local intercommunication could only be had with the consent of the National Company, unless they came, as in some other places, within the Telegraph Act, 1899. This might be effected whenever the Corporation exchange became the larger one. "In conclusion," says Mr. Bennett, "I have no hesitation in recommending the Corporation to apply for a license, and under it to construct and work a telephone system of their own. With the advantages of underground construction, metallic circuits, modern instruments, and ready-made wayleave facilities, which would lie with the Corporation, doubt as to the thorough success of the undertaking cannot be reasonably entertained. The application of the tariffs I have proposed would certainly result in a substantial yearly profit, which could either be devoted to relieving the rates or to a further reduction in telephone charges."

Telegraph Interruptions.—In the House of Commons on 21st inst., in reply to questions as to the effect on the telegraphic and telephonic services of the storms towards the end of last year, Mr. Austen Chamberlain said that the November storm caused no total interruption between London and any commercial centre in the country, except intermittently during the night of the 13th with places in Scotland. On six days in the month, however, the delay on the Glasgow circuits amounted to one hour and upwards; and this was also the case on four days in the month on the Newcastle circuits, on two days on the Liverpool circuits, and on one day on the Cardiff circuits. In December the wires to Glasgow, Liverpool, and Newcastle were totally interrupted for the greater part of four days. Cardiff was not entirely cut off. On the direct wires between Newcastle and Cardiff the interruptions in November were from the 12th to the 15th, and in December from the 9th to the 19th; but, except for a short time, communication was maintained by other wires. Between Newcastle and Glasgow there was no total interruption, but in December there was a delay of 35 minutes on the 16th. The loss of revenue from the November interruptions was about £2,500, and from the December interruptions about £5,500.

The cost to the Post Office of making good the November breakages was about £2,500, and the December repairs will probably cost nearly £27,000. These sums do not include the expense incurred by the railway companies in carrying out their obligations to the department. It will not be possible to prevent interruptions, but the Postmaster-General hopes that the measures which have been taken to strengthen the lines and to provide reserve wires will render them less serious; and the continuation northwards of the Birmingham underground line will be of great help.

Telegraphic Interruptions and Repairs :—

CABLES.	INTERRUPTED.	REPAIRED.
Latakia-Cyprus	.. June 20, 1899 ..	..
Para-Maranham	.. March 1, 1900 ..	..
Mole St. Nicholas-Port au Prince	.. Dec. 28, 1901 ..	..
Alexandria-Laruaca	.. Jan. 19, 1902 ..	Jan. 29.
Havre-Waterville	.. Jan. 27, 1902 ..	..
Shanghai-Hong Kong	.. Jan. 24, 1902 ..	..
LANDLINES :—		
"Via Hanekin" on Persian territory ..	.. Feb. 24, 1900 ..	..
Communication with Baranquilla and Cartagena	Dec. 8, 1900 ..	..
Cap Haitien-Port au Prince	.. Jan. 22, 1902 ..	Jan. 23.
Bertsch-Sukhoum	.. Jan. 22, 1902 ..	Jan. 24.

Underground Telegraphs.—The Glasgow Chamber is to co-operate with the Edinburgh and other Scottish Chambers in arranging a deputation to the Postmaster-General to urge the Government to expedite as far as possible the completion of underground telegraphic communication to Scotland.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—February 12th. Tramway poles, bases and trimmings for Corporation. See "Official Notices" January 24th.

Aberdeen.—February 15th. Overhead equipment, poles and bonding; also cables for three tramway routes. See "Official Notices" to-day.

Belgium.—February 15th. Proposals are being invited by the municipal authorities of Lourain for the lighting of the public streets by electricity or gas.

Belgium.—March 1st. The municipal authorities of Ghent are inviting tenders until the March 1st, 1902, for the concession for an electric lighting installation. See our "Official Notices" January 3rd.

Birkenhead.—The Corporation invite tenders for supplies of tools, bolts, nuts, steel, &c., brushes, gun-metal, block tin; paints and oils; rubber goods and packing; cement and sundries; as required at the electricity works for the year ending March 31st, 1903. Particulars, &c., from Electrical Engineer, Generating Works, Craven Street, Birkenhead.

Birkenhead.—February 11th. Feeder mains, pilot wires, and distributing mains for Rock Ferry and district for the Corporation. See "Official Notices" January 24th.

Bournemouth.—February 12th. Steel poles, overhead lines, section boxes, arc lamps, poles and carriers, for the T.C. See "Official Notices" to-day.

Brighton.—February 10th. Ten tramcar bodies, trucks, and electrical equipments for the Corporation. See "Official Notices" to-day.

Croydon.—February 17th. 10 double-deck double-truck cars with motors, &c., for Corporation. See "Official Notices" January 24th.

Dulverton.—The E.L. Committee invites proposals for lighting the town. See "Official Notices" to-day.

Fulham.—February 26th. Two 50-KW. steam dynamos and boosters, four dryback marine boilers, battery, and wiring for 2,000 lights, for the Guardians. See "Official Notices" to-day.

Glamorgan.—The County Council is now inviting tenders for the erection of an electric plant house at Bridgend Asylum. Particulars of W. E. R. Allen, County Council Offices, Cardiff.

Glasgow.—February 21st. Switchboard extensions for the Corporation. See "Official Notices" to-day.

Hamilton.—February 6th. The T.C. wants offers from companies willing to lease the electric lighting order. See "Official Notices" to-day.

Hammersmith.—February 12th. Electrical stores and Welsh coal, 12 months' supply for the Council. See "Official Notices" to-day.

Leeds.—Concentric (high tension), two-phase (low tension), and L.T. triple-concentric paper cables for the electric lighting department. See "Official Notices" to-day.

Leyton.—February 13th. Steam and other piping for U.D.C. electricity works. See "Official Notices" January 24th.

London.—February 12th. In a list of details required by the London School Board for twelve months we observe "electrical necessaries" for the *Shaftesbury*. Forms of tender, &c., at the offices, Victoria Embankment.

London.—March 4th. The L.C.C. is wanting tenders for 100 or 50 double-deck double-bogie tramcars for conduit lines in South London. Drawings, &c., at the County Hall, Spring Gardens, S.W. (£3).

Lytham.—January 31st. The U.D.C. invites tenders for the erection of engine and destructor houses, and cottage; and for two centrifugal pumping engines, steam dynamo, electric light fittings and travelling crane. Specifications, &c., of the engineer to the Council, Mr. A. J. Price, U.D.C. Offices, Lytham.

Manchester.—February 13th. Condensing plant, cooling towers and feed water heaters for the Corporation. See "Official Notices" January 24th.

Middleton.—February 1st. The Corporation wants tenders for the electric wiring and fitting of the Free Library, Long Street, and Technical School, Suffield Street.

Newcastle.—February 12th. The Corporation wants tenders for laying 1½ miles of single line tramway, &c. Specifications from the City Treasurer (£3 3s.).

Oban.—The Town Council wants tenders for wiring consumers' premises on the "easy" system. Apply to Mr. Alex. Black, Town Clerk.

Rochdale.—February 2nd. Lighting switchboard extensions for the Corporation. See "Official Notices" January 17th.

Rockhampton (Australia).—March 31st. The Council of the Municipality of Rockhampton is prepared to consider applications from companies desirous of undertaking the construction and working of a system of electric tramways under the Queensland Tramways Act of 1882, and the Amendment Act of 1890. See ELECTRICAL REVIEW, January 10th.

Salford. — February 8th. Two 150-KW. continuous current motors for the electricity works. See "Official Notices" January 24th.

Shipley.—The D.C. is inviting tenders for the construction and reconstruction of about 1½ miles of double line.

Shipley.—February 10th. Traction switchboard, boosters and balancers, switchboard alterations, for the Council. See "Official Notices" January 24th.

Spain.—February 2nd. The municipal authorities of Elgirbar are inviting tenders until February 2nd, for the establishment and equipment of a central electric lighting station in the town. Particulars may be obtained from, and tenders are to be sent to, El Secretaria del Ayuntamiento de Elgirbar, Spain.

Spain.—February 9th. Tenders are being invited until February 9th, by the Municipal authorities of Irun for the concession for the electric lighting of the town. Tenders are to be sent to El Exmeo Ayuntamiente Constitucional, Irun, Spain, whence particulars may be obtained.

Sunderland.—February 6th. 10 double and four single-deck car bodies, trucks, &c. See "Official Notices" January 17th.

Walsall.—January 31st. One each 500-H.P. and 25-H.P. high speed engines, and 350-KW. and 16 KW. dynamos for the electricity department. See "Official Notices" January 17th.

West Ham. — February 11th. Engine room stores, cable, boxes, transformers, lamps, electrical instruments, &c., for the Council. See "Official Notices" to-day.

Wigan.—February 3rd. Cables and trolley wire. See "Official Notices" January 24th.

CLOSED.

Bilston.—The contract for certain electrical plant for the Bilston sub-station of the Midland Electric Corporation for power distribution has, according to the *Contract Journal*, been placed with the British Westinghouse Company at £5,850. The lowest tender was that of the Lahmeyer Electrical Company at £3,565, and the highest that of the Electrical Construction Company at £10,070.

Brecon.—The Committee of Visitors to the Brecon and Radnor Joint Counties Asylum have accepted a tender for carrying out the electric lighting of the building at a cost of £3,420.

Coventry.—The E.L. Committee of the Corporation has decided to recommend the acceptance of a tender of Messrs. J. and H. McLaren for a 1,000-H.P. engine at £4,275, and a tender of the British Schuckert Company for a 600-KW. two-phase alternator at £1,580.

London County Council.—At a meeting of the Council on Tuesday the Fire Brigade Committee reminded the Council of the recent acceptance of the tenders of Messrs. Ellis, Potten & Co. to wire and supply fittings at the West Hampstead, East Greenwich and Perry Vale fire stations and the Homerton sub-station, and to

to pay a heavy fine.

about £2,500, and from the December interruptions about £5,500.

carry out similar work at the Manchester Square and Bishopsgate Stations. As the firm had signed the contracts in respect of the first four mentioned stations, the order was given for the work at the West Hampstead and East Greenwich Stations, which were nearly finished, but, by the desire of the contractors, the issue of the order with regard to the Perry Vale and Homerton Stations was suspended. The Committee stated that the progress made by the company with the work at West Hampstead and East Greenwich had not been very satisfactory, and the contractors now asked, in view of their financial position, that they might be relieved of the work as regarded all the stations except those two which they had undertaken to complete shortly. The firm had been notified of the acceptance of their tenders for the Bishopsgate and Manchester Square Stations, but, up to the present, they had not signed the contracts, and, under the circumstances, the Committee expressed the opinion that it would be well to relieve the firm of their responsibility in respect of the work at Perry Vale, Homerton, Bishopsgate, and Manchester Square, but that the firm should not be allowed in future to tender for any work for the Council. The Committee submitted recommendations to this effect, which were carried.

Pontypridd.—The D.C has accepted the following tenders for the supply of plant for lighting and tramways. There were 341 tenders:—

	£ s. d.
Boilers, Babcock & Wilcox	5,611 2 0
Engines, Coombe, Barbour & Co., Belfast ..	5,210 0 0
Dynamos, Greenwood & Batley	3,401 0 0
Balancers, British Westinghouse Company ..	760 0 0
Switchboard, &c., divided between Ferranti and Kelvin and White	2,473 0 0
Fitter's shop, Newbolds	594 0 0
Travelling crane, Chatteris	455 10 0
Arc lamps, Johnson & Phillips	788 5 0

The total amounting to £17,292 17s.

Willesden.—The Guardians have received the following tenders for the electric light and power installation at the new Infirmary, Acton Lane, to the specification of Mr. Morgan Williams, M.Inst.C.E.

Name.	Section A. Boiler house plant.	Section B. Engine and battery room plant.	Section C. Wiring and mains.	Section D. Crane, motors, fans.	Total amount of tender for complete works.
	£ s.	£ s.	£ s. d.	£ s.	£ s. d.
Carrick & Ritchie ..	—	—	—	*86 0	—
J. Carrick & Sons ..	—	—	—	738 0	—
Do. ..	—	—	—	630 0	—
Belshaw & Co.	—	—	2,143. 6 8	—	—
Troy & Co.	—	—	2,861 0 0	—	—
Tinkers, L'd.	4,822 0	—	—	—	—
Danks & Co.	4,088 10	—	—	—	—
Lowcock & Co.	*292 0	—	—	—	—
Davey, Paxman & Co.	3,873 10	2,815 10	—	—	—
Do. ..	—	3,025 5	—	—	—
Do. ..	—	3,135 10	—	—	—
Holmes & Co.	—	3,073 0	—	597 0	—
Do. ..	—	3,293 0	—	—	—
Do. ..	—	3,048 0	—	—	—
Do. ..	—	3,118 0	—	—	—
Electrical Construction Co.	—	3,097 0	—	701 0	—
Brush Electrical Co. ..	—	2,852 0	—	592 0	—
Siemens Bros.	—	2,800 0	—	633 0	—
Do. ..	—	2,640 0	—	—	—
Do. ..	—	2,630 0	—	—	—
Mather & Platt	—	2,946 0	—	651 0	—
Do. ..	—	2,926 0	—	544 0	—
Do. ..	—	3,016 0	—	—	—
Geipel & Lange ..	—	2,816 14	*1,802 0 0	*891 10	—
Do. ..	—	2,866 14	—	—	—
National Electric Wiring Co.	—	—	2,258 10 0	—	—
Crompton & Co. .. (accepted)	3,571 0	2,882 0	1,612 0 0	642 0	8,707 0 0
Johnson & Phillips ..	3,795 0	2,780 0	1,559 16 8	590 0	—
Do. ..	—	—	—	540 0	8,764 16 8
Spagnoletti & Co. ..	—	—	1,983 14 0	—	—
Alley & Maclellan ..	5,106 0	3,015 0	2,115 0 0	1,540 0	11,776 0 0
Do. ..	—	—	—	1,215 0	—
Spencer & Co.	—	—	—	*110 0	—
Bruce Peebles & Co. ..	—	2,961 0	—	—	—
Do. ..	—	2,899 0	—	778 0	—
Leaf, H. M.	—	—	2,114 16 8	—	—
Strode & Co. ..	—	—	2,675 16 0	—	—
Newton Electrical Works, Ltd.	—	2,675 0	—	*275 0	—
Mavor & Coulson ..	—	2,864 17	—	565 10	—
Do. ..	—	2,953 7	—	—	—
Do. ..	—	2,981 17	—	—	—
Do. ..	—	3,031 1	—	—	—

* Tender for portion of a section only.

Woolwich.—The following is a list of tenders received for electrical instruments for the Woolwich Borough Council's electricity department (engineer and manager, Mr. J. B. Mitchell):—

Siemens Bros. & Co., Limited	£781 10 0
Elliott Bros.	620 5 0
Kelvin & James White, Limited	612 16 0
Everett, Edgcumbe & Co. Limited (accepted)	526 12 6
International Electric Company, Limited (offer incomplete)	138 7 0
Gambrell Bros. (offer incomplete)	86 1 0

Royal Society.—Among the papers down for reading yesterday afternoon was one by Prof. E. Wilson on "The Distribution of Magnetism as affected by Induced Currents in an Iron Cylinder when Rotated in a Magnetic Field."

FORTHCOMING EVENTS.

Friday, January 31st.—At 9 o'clock. Royal Institution of Great Britain. Discourse by Prof. A. Crum Brown, F.R.S., "The Ions of Electrolysis."

At 8 o'clock.—Electro-Harmonic Society Smoking Concert.

Saturday, February 1st.—At 2.30 p.m. Institution of Electrical Engineers (Students' Section). Visit to the Willesden Station of the Metropolitan Electric Supply Company.

Monday, February 3rd.—At 7.30 p.m. Society of Engineers. Meeting at the Royal United Service Institution, Whitehall. Inaugural address by Mr. Percy Griffith.

Thursday, February 6th.—At 8.30 p.m. Röntgen Society. General meeting, at 20, Hanover Square. Paper by Mr. E. W. H. Shenton on "A System of Radiography."

At 6 p.m.—Chemical Society. Paper on "An Investigation into the Composition of Brittle Platinum," by Mr. W. H. Hartley.

Friday, February 7th.—At 8 p.m. Institution of Junior Engineers. Meeting at the Westminster Palace Hotel. Paper on "The Electric Passenger Elevator," by Mr. William J. Cooper.

Monday, February 10th.—Institution of Electrical Engineers (Newcastle Section) Meeting. Paper on "Electrical Legislation and Finance," by Mr. H. W. Handcock.

Tuesday, February 11th.—At 9 p.m. Institution of Electrical Engineers (Glasgow Section). Meeting at the Institution of Engineers and Shipbuilders, 207, Bath Street.

At 7.30 p.m.—Institution of Electrical Engineers (Manchester Section). Meeting at Owens College. Paper by Mr. C. E. Stromeyer on "Steam Boilers."

Wednesday, February 12th.—At 7.30 p.m. Institution of Electrical Engineers (Birmingham Section). Meeting in the Physical Theatre of the University.

NOTES.

Errata.—In Mr. Mervyn O'Gorman's remarks on wireless telegraphy on page 201, the following corrections should be made:—Line 3, for "by coherer relay," read "by a coherer;" line 8, for "therefore," read "furthermore"; paragraph 3, line 1, read "Various branches of electric science are so much interlocked." In our leading article to-day, for Sir James, read Sir Joseph Dimsdale.

Companies and Street Traffic.—At the London County Council meeting last week, on the motion of Mr. Foster, seconded by Mr. S. Sankey, the Council resolved to refer to the Highways Committee to consider and report as to the best means for the Council to procure such statutory powers as to secure that all persons or companies having Parliamentary powers to open the roads should be compelled to give adequate notice to the Council before exercising such powers, and that the Council should have the power to make such regulations and have such supervision as would ensure the work being done expeditiously and with full regard to the public safety and business interests.

Lectures.—Prof. W. Robinson recently delivered the first of a series of three popular lectures on "Electric Light and Traction" at the University College, Nottingham.

At the Cleveland Institution of Engineers at Middlesbrough on 21st inst., M. B. de Szyszkowski, of Paris, read a paper on "Electrical Accumulators."

Memorial to Principal Viriamu Jones.—The *Times*, on Saturday last, contained the following interesting paragraph:—"The determination of the fundamental unit of electrical resistance by the late Principal Viriamu Jones ranks among the most important of such determinations, and justly acquired for him a foremost position among physicists. This determination was carried out by means of a modification of the Lorenz method, and a machine for the purpose, on which he spent £400, was erected by Principal Jones at the University College at Cardiff. He was, however, of opinion that improvement was possible, and accordingly the Drapers' Company, in 1898, in recognition of his signal services, both to science and education, voted to him the sum of £700 for the construction of more perfect apparatus. This apparatus he proposed ultimately to set up at the National Physical Laboratory, where preparation had been made to receive it. His illness and death prevented the realisation of these hopes, but the Drapers' Company have, with great generosity, and with a view of showing their appreciation of his merits, confirmed their vote, and announced their intention of putting the sum of £700 at the disposal of the Committee of the laboratory for the complete equipment of a Lorenz apparatus as a memorial to Principal Jones. The apparatus is to be erected under the supervision of Prof. Ayrton, F.R.S., and the director. This valuable gift has been accepted by the Committee of the laboratory. A tablet will be affixed to the apparatus stating that it was presented by the Drapers' Company in memory of Principal Viriamu Jones, and in recognition of his great scientific attainments."

and Perry Vale fire stations and the Homerton sub-station, and to

Architects and Commission on Electricity Contracts.—Mr. Justice Bucknill made an important statement at Lancaster Assizes on Monday affecting the question whether architects are entitled to charge commission upon the electrical portion of contracts, when the latter are under the supervision of an electrical engineer. The sum of about £500 had been spent by the defendants, Messrs. John Scott and John Gardner, in equipping the Alhambra Music Hall, at Morecambe, with electrical plant, and in a claim for £379, balance of money owing as commission, the architect, Mr. Herbert Howarth, of Morecambe, included the sum expended by the defendants on the electrical plant and wiring. The electrical engineer who had charge of the work, Mr. Bragger, gave evidence on behalf of the plaintiff, and stated that he found Mr. Howarth had commission on the wiring, it being originally intended to take the electrical current from the town's supply. When defendants decided to put in their own plant, he consulted with Mr. Howarth, and got a plan of the cellar from him. The cellar was lowered to give room for the dynamos. In other places, unless specially mentioned in the contract, he had known architects receive commission on the electrical part of the contract. During the hearing of the case his Lordship said he should want a great deal of evidence to satisfy him that when electrical machinery was put down under the supervision of an electrical engineer, the architect was entitled to charge commission on the engine and plant. His personal opinion was that with regard to the alteration of any part of the ground to prepare the engine beds, where there was potential danger to the foundations already put in, the architect would be entitled to charge commission to that extent, but not upon the capital put into machinery and electrical plant. His experience was that architects knew very little about electrical matters, and these were dealt with by expert engineers.—The case was adjourned to Manchester Assizes.

Mr. Wright's Paper on Demand Indicators.—In the article which appeared in our issue on January 10th, it is rather implied that the Electrical Power Distribution Co. and the Brompton Co. have adopted the new tariff and are using demand indicators. This is not so, at any rate in the case of the Brompton Co.

Electrical Volunteers.—On Saturday last another company, consisting of Lieutenant J. H. Stubbs and 51 non-commisioned officers, left for active service in South Africa. The men assembled at the Electrical headquarters, Regency Street, Westminster, and entrained at Waterloo for Southampton, where they embarked on board the *Dunottar Castle*.

Appointments Vacant.—Shift engineer for the Sheffield Corporation tramways power station at £120; clerk for the Manchester tramways traffic superintendent's office at £150. Temporary draughtsman for Southend; shift engineer for Sheffield tramways at £120; various assistants are wanted by the County of Surrey L.P.D. Co., Limited; a resident engineer at £150 for Oban; and a junior shift engineer for Swansea electricity works.

Personal.—The New York *Electrical World* announces that Lord Kelvin is to visit the States once more early next April, doubtless accompanied by Lady Kelvin, and adds: "The great physicist is now well advanced in years, and we are heartily glad to learn that he is in such robust health as to be equal to a long ocean voyage. Electrical engineers will, of course, take proper steps to show him honour."

We are pleased to learn that ex-Bailie Paton, convener of the Glasgow Corporation Tramways Committee, who has been seriously ill for some time, is now out of danger.

Mr. W. S. Brooks, B.Sc., of Barnsley, has been appointed lecturer and demonstrator in physics and electrical engineering to the Technical School, Norwich.

Mr. E. Rotter, A.M.I.C.E., has resigned his appointment as general manager of the Portsmouth Corporation tramways, resuming his former position as engineer, in order that he may engage in private practice. Mr. Rotter has been retained by the Provincial Tramways Company as consulting electrical engineer for the Portsdown and Horndean Light Railway, and will be appointed consulting engineer to the Portsmouth Corporation tramways on the completion of their conversion to electric traction.

Ferranti v. British Thomson-Houston Company.—Mr. Justice Swinfen Eady on Wednesday gave judgment in this action, which was one to restrain an alleged infringement of an electric patent. The term of the patent had expired, and the question came to be one of damages caused by the alleged infringement during the run of the patent. His Lordship found that the defendants had not infringed, and the action accordingly failed, with costs.

Obituary.—The death occurred recently of Mr. Samuel Dixon, engineer, of Messrs. Kendall & Gent. Mr. Dixon was a past-president respectively of the Manchester Section of the Engineering Employers' Federation and of the Manchester Association of Engineers. Many engineering firms were represented at the funeral, which took place at Marple on 23rd inst.

Electrical Machinery in Warships.—The *Times* of 21st inst. published the following interesting announcement from "A Naval Correspondent":—"The Admiralty have quite recently decided—in connection with the care and maintenance of certain of the more important portions of the machinery supplied to British men-of-war—to make a change which may possibly have far-reaching results. The engineer officers of a ship have hitherto been required to undertake the charge of, and to be responsible for, the maintenance in a state of efficient working order of the following, among other parts of the machinery:—All steam and hydraulic pumping and other engines for loading and working the guns, for supplying ammunition, and for turning turrets, barbette platforms, and other forms of gun mountings; all Whitehead and other torpedoes, and submerged tubes and gear; and all electric light engines and dynamos. It has also been a special instruction to the captains of ships in regard to the torpedoes, that "the dynamos and engines for driving them are in charge of the engineer officer, who is responsible for their mechanical and electrical efficiency." The result of this arrangement, by which one man was responsible for the effective working of a machine and another for its efficient use, was not always happy, and somewhat conducive to friction. Moreover, it has had a distinct bearing on the burning question of the position of the engineer officers of the Navy, and has been one of the principal arguments used in the rather heated discussion which has arisen out of that matter. By the new regulations all this is to be altered. The gunnery lieutenant is in future to take charge of all the hydraulic machinery which is in any way connected with the gun mountings, while the torpedo lieutenant is to be responsible for the dynamos, motors, torpedoes, and all the fittings which have to do with torpedo armament. All these matters have thus been removed from the care and control of the engineer officer, who will now be simply required to provide steam to work the dynamos and hydraulic engines. . . . . That the Admiralty are quite alive to the importance of the step which they have taken is shown by their call for reports on the subject of the provision of a staff for the assistance of the gunnery and torpedo lieutenants in carrying out work of this special nature. It is intended apparently that the new rating of electrician shall assist the torpedo lieutenant, and probably some similar rating will be supplied to assist in looking after the hydraulic machinery. Whether the change has been decided on upon good and substantial grounds, and whether it will make for increased efficiency, are questions which must be left for time and experience to demonstrate. It would seem, however, that there is a very general opinion among naval executive officers that the answer will be in the affirmative."

Foreign Electric Plant.—It is satisfactory to find that the imports of foreign electrical goods and apparatus in this country are not on so large a scale as formerly. During December last such imports attained a value of £54,447 as compared with £52,961 in the previous month, and £147,205 in December, 1900. During the whole of the past year the imports only amounted to a value of £849,257 as against £1,265,946 in 1900.

Grease Chariots.—On the Union Traction Company's system for Philadelphia all the curves on the line are greased at least once a day. To send men round on foot would render it a slow process. It is unpleasant to passengers for the grease men to go about on the cars, and each man is therefore provided with a small pony cart on two wheels sufficient to carry two pails of grease, sand, salt, a switch iron and a broom. Some curves are greased as often as four times daily. The cart is sufficient to carry everything a man will require in a day. We believe that the greasing of curves is an undoubted economy, and one that might with advantage be adopted more than it has been. The practice of sending the men round in a small trap instead of letting them work their will on passengers is also a good one. On the steam railroads of this country it appears to be the practice for the dirtiest men from the engine sheds to be sent home by the trains just when cleaner people are going home. Any consideration for passengers is of course out of the question.

THE CENTRAL STATION ENGINEER.

Personal.—Mr. C. A. BLASCHECK, of Norwich, has been appointed electrical engineer to the Canterbury Town Council, in succession to Mr. Norman Stanland.

Mr. H. HOWARD, of the Leicester electric lighting department, has been appointed chief assistant distributing engineer to Manchester Corporation E.L. and Tramways Department.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Easton & Co., Limited (68,181).—Particulars of registered mortgages and charges:—Date of creation of mortgage or charge, May 17th, 1901; amount secured, £150,000 first mortgage debenture stock; date of resolution creating debenture stock, December 13th, 1900; property charged, all and singular the freehold and leasehold property of the company, and all letters and patent rights, and all the undertaking and business of the company, including unpaid capital; trustees, The London Trust Company, Limited, 37, Lombard Street, E.C.

SUPPLY STATION ACCOUNTS.

Bath Corporation Electricity Accounts.

WHEN we dealt with the 1898 and 1899 accounts of the electricity undertaking of the Bath Corporation, the remark was made that they showed a considerable improvement. This comment applies with even more force to the accounts we analyse below. The output is largely increased, the costs have been reduced, and the net loss (although still over £1,200) is only two-thirds of what it was in the previous year.

GENERAL STATEMENT.

	1899.	1900.	Inc.
Total capital expenditure ...	£63,006	£78,450	£15,444
Number of units sold	388,208	606,876	218,668
Maximum load in KW.	382	493	111
No. of 30-watt lamps connected	—	24,698	—
Gross revenue	£7,296	£11,763	£4,467
Gross expenditure...	£5,123	£7,419	£2,296
Gross profit	£2,173	£4,344	£2,171
Average price per unit sold ...	4·33d.	4·31d.	—·02d.

The average price for energy has been practically maintained, and there is little change in the revenue statement. Bank interest accounts for the rise in the average from all sources. The output was taken in large part by the public lamps, being distributed as follows:—

	Units generated.	Sold, public lamps.	Sold, private consumers.	Number of public lamps.
1897	514,224	138,200	176,520	88 arcs
1898	537,052	169,385	187,315	87 arcs and 21 incandescents of 16 C.P.
1899	569,986	179,261	208,947	88 arcs and 13 incandescents of 50 C.P.
1900	858,103	253,762	353,114	155 lamps of 600 watts.

The maximum load during the year was 493 KW., to meet which 1,000 KW. of installed plant was available. The charges in force are, private lighting 5d. and power 3d. per unit; public lamps each £25 per annum.

REVENUE STATEMENT.

	1899. Gross.	1899. Per unit.	1900. Gross.	1900. Per unit.	Inc.
Sale of energy	£6,996	4·33d.	£10,903	4·31d.	—·02d.
Meter rents	259	·16d.	375	·15d.	—·01d.
Sale of material, &c.	33	·02d.	57	·02d.	·00d.
Sundry premiums, &c., and banker's interest.	8	—	428	·17d.	+·17d.
Gross revenue ...	£7,296	4·51d.	£11,763	4·65d.	+·14d.

Mr. Metzger, who left Bath for Manchester a few months ago, must be congratulated upon the reduction during his last year of office of the works costs by nearly ½d., and total cost by almost ¼d. per unit, in face of an increase in the coal item of nearly ½d.

COST OF PRODUCTION.

	1899. Gross.	1899. Per unit.	1900. Gross.	1900. Per unit.	Inc.
Coal	£1,701	1·05d.	£3,075	1·22d.	+·17d.
Oil, waste, water, and engine room stores.	554	·34d.	519	·20d.	—·14d.
Salaries and wages incurred in generation and distribution, attending street lamps	1,032	·64d.	1,441	·57d.	—·07d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	394	·25d.	532	·21d.	—·04d.
Works costs	£3,681	2·28d.	£5,567	2·20d.	—·08d.
Rent, rates and taxes ..	131	·08d.	276	·11d.	+·03d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	1,084	·67d.	1,369	·54d.	—·13d.
General establishment charges, stationery and printing, law charges and insurance	208	·13d.	203	·08d.	—·05d.
Other expenses: Special discounts allowed.	19	·01d.	4	·00d.	—·01d.
Total costs ...	£5,123	3·17d.	£7,419	2·93d.	—·24d.

The financial position is greatly improved by the increase in revenue. To obtain this, the expenditure was only augmented by half the extra receipts, and the £2,171 thus carried to net revenue account covered the additional financial calls, amounting to £1,605, and left £566 to diminish the previous loss of £1,805 to £1,239. In a year or two Bath ought to be able to pay its way.

PROFIT STATEMENT.

	1899.	1900.
Interest on loans	£1,732	£3,178
Sinking fund for repayments	2,246	2,405
Net profit carried forward	—1,805	—1,239
Gross profit	£2,173	£4,344

CITY NOTES.

Sussmann Electric Miners' Lamp Company.

THE report to be submitted at the meeting on the 11th prox. states that the accounts cover the period from the reconstruction in August, 1900, to December 31st last, and show that 20,677 shares were applied for and allotted credited with 17s. 6d. per share paid up, and that the cash actually received amounted to £2,584. Out of this sum £1,254 was of necessity paid away to satisfy the liabilities of the old company and the liquidation expenses. During the above-named period every effort has been made to effect sales of the lamps both by personal visits to collieries, interviews with colliery owners, and by means of correspondence and circulars, but the directors regret to say with only very indifferent success. Several important collieries have had sample installations of the lamps, and in each case with favourable results, but the owners do not seem disposed to lay aside the oil lamps in large quantities in favour of the Sussmann. In the present condition of the colliery world it seems a fixed resolve not to embark in the outlay of any additional capital. The directors, in common with all the shareholders, feel the keenest regret that an invention so eminently useful and practical as the Sussmann electric miners' lamp has not been appreciated at its true worth by colliery owners, especially so as it has received the most complete approval wherever it has been used, and it has also been very favourably reported on by the leading miners' experts of the day. The endless delays affecting negotiations for the sale of some of the foreign patents forbid the directors from holding out any hope of success on this point. The only alternative to liquidation is for the shareholders to take up the whole of the unpaid capital of 9,323 shares credited with 17s. 6d. paid, which would give the company a further working capital of £1,165. Alternately, under all the circumstances, the directors have come to the conclusion that the shareholders should not be asked to embark any further capital in the business, but submit to them the desirability of a final liquidation of the company and the sale of all the patents for the best price that can be obtained.

Typewriting Telegraph Corporation.

THE adjourned meeting of this company was held on 23rd inst. at Winchester House, Sir James Fergusson, M.P., presiding. Sir James explained that the poll taken on the proposed adoption of the committee's report—which recommended that the board should be called on to resign—had resulted in favour of the committee by a large majority. The directors, being desirous of giving effect to the shareholders' wishes as quickly as possible, had conferred with the committee as to the best course to pursue. There were at present five directors, the *maximum* number under the articles being seven, and it was, therefore, proposed that two members of the committee should be elected to seats on the board on this occasion. In order to make their resignation effective, the existing directors had to give a month's notice of their intention, and they would do this now. It would be possible in this way to carry on the business during the interval which must elapse before the election of a new board. Mr. A. J. PARKER (chairman of the committee said, according to the *Times* report, that the arrangement referred to by chairman had the approval of his colleagues. He added that Mr. Wilfrid King, as the representative of the Exchange Telegraph Company on the directorate, would retain his seat. After a short discussion, Mr. Parker and Mr. G. H. Chantrey were elected directors, and the meeting was adjourned *sine die*, it being understood that the shareholders would be again called together when the constitution of the new board was completed.

Prospectus.

IN our Business pages to-day will be found the prospectus of the Trafford Power and Light Supply (1902), Limited, whose nominal capital is £150,000 in £1 ordinary shares, and £75,000 4½ per cent. debenture stock. The present issue consists of 94,500 ordinary shares, and £50,000 of the debentures all at par. The objects of the company, which are already pretty familiar to readers of the ELECTRICAL REVIEW are stated in detail in the prospectus, so we need not refer to them at length here. We may refer readers to the ELECTRICAL REVIEW for November 1st and 8th, 1901, in which an illustrated description of the works of the company appeared. If there is one district which has stood out as a very desirable situation for the establishment of new manufactories during the past few years, it is that of Trafford Park, and for these and other purposes, applications for electrical energy have already been received to the amount of 2,629 KW. It is considered that the present demand is sufficient to put the company on a substantial profit-earning basis, and of course many new works and factories are to be set up in the locality, which will doubtless draw upon the company's commodities of Mond fuel gas, and electrical energy. The list closes on Thursday, February 6th.

Direct United States Cable Company.

SIR JAMES PENDER presided (in the absence of Mr. E. M. Underdown) at the meeting of this company held on Tuesday at Winchester House. In moving the adoption of the report, of which we gave an abstract last week, he said that the revenue for the six months to December 31st, after deducting out-payments, amounted to £49,589, while the working and other expenses absorbed £21,558, leaving a balance of £28,031 as net profit, making with £3,532 brought forward, a total of £31,563. The manner of its appropriation was stated in the report. The revenue showed a reduction of £945, which must be considered satisfactory, having regard to the fact that an additional competing cable had only been working four months in 1900 as against the full half year in 1901. The pay-

ment for Sunday duty accounted for a small addition to the salaries account at stations, and the necessary renewal of testing apparatus at the Halifax station accounted for some additional outlay. £47 appeared for repairs of cables, but this was only for a charge in respect of the renewal of a street cable running from the cable hut to the station in the city of Halifax. They had had no sea cable repairs in the half-year; the main and shore sections worked, and were continuing to work, very satisfactorily. Since the practical renewal and relaying of some miles on the Irish side last year, the duplex working had been most satisfactorily carried on. The reserve fund had been increased by £17,020, bringing it up to £448,000. The investments had been increased by £18,133, bringing the total up to £438,768 at cost price—the present market value is more than £10,000 in excess of cost. The cable was as good as new, and their relations with the associate companies continued good, and when they were doing very fair business, he did not think there was—with one exception—much to be said. The exception was in reference to a great deal that they had heard and read about in reference to the Marconi system of wireless telegraphy. The general consensus of expert opinion as far as he could hear, was against the Marconi system having any effect (commercially as against short or long-distance cables. He had made many inquiries, and found experts all of one opinion. Years ago Lord Kelvin said he had very grave doubts that it would ever come out as a commercial success. No attempt had been made to bring it out on a working basis. Although messages had been sent, they had been from an experimental, rather than from a financial, point of view, and he thought that, until Mr. Marconi could show something which worked out successfully, and incline people to put their money into his venture, they, as shareholders, need not be very much afraid. Experiments, as they knew, had been made on ship during the tour of the Prince of Wales, and on many occasions they had been very disappointing. At other times they had been fairly successful, and wireless telegraphy was being employed to some extent in some of the Channel and Atlantic steamers, but that did not appeal to them very much as shareholders in cable companies. Even if worked successfully, the amount of traffic which could be carried would be so small as not to affect appreciably the receipts of the cable companies. It was only possible to arrange a certain number of tones, and it would be difficult to work enough stations at the same time and carry on an amount of traffic that would in any way interfere with them. Wireless telegraphy was finite, they could work it up to a certain extent, if proved a success, but there was a limit; but there was no limit to the amount of cable they might put down in the deep sea. In any case, they were more infinite than Mr. Marconi. As to the elements, there had been a proposal made that the Government should have a submarine cable for long distances to assist, and perhaps, at certain times, supplant, the overhead wires. That was, to a certain extent, in the company's favour. Whatever the landlines suffered from the elements, Mr. Marconi's system would be suffering even more than this company did with their landlines. The height of the poles, and the elements themselves, would probably create great disturbances. He commended to their notice an amusing article on the Marconi system in *Punch*, also two articles in the ELECTRICAL REVIEW, and one in the *Electrician*. All of these would give great comfort to those of their shareholders, who felt at all doubtful at the present moment. In reference to the great fall in their shares and cable shares generally, he might remind them that in 1890 gas shares fell to an enormous extent, because electric lighting was practically become a fact in this country. Now the annual increase only in the receipts from gas was more than the total receipts from electric lighting. He was only taking that as rather *à propos* to soothe their shareholders, so that they might not be anxious to throw away a good investment. Regarding themselves, he might mention that their reserve fund was worth £7 10s. per share, apart from any goodwill or anything else that they had got; he only wished to point out that they had intrinsic value for their money. The chairman added that they did not notice any fall in the electric tram or omnibus shares in Paris on account of M. Santos-Dumont's tour round the Eiffel Tower.

Mr. VARLEY seconded the adoption of the report, and this was unanimously carried.

Great Northern and City Railway Company.

THE report for the half-year ended 31st ult., to be submitted at the meeting to be held on the 4th prox., states that, with the exception of part of the station tunnels and one or two short lengths, the tunnels between Drayton Park and Finsbury Pavement are driven to their full extent. At Drayton Park the up and down line tunnels have been driven northwards 54 and 139 lineal yards respectively. At Essex Road station the connecting passages from the shafts are nearly completed, and about 800 yards of tiling have been done. At Old Street the up line station tunnel has been driven to its full extent, and the down line station tunnel a distance of 123 lineal yards. At the Finsbury Pavement terminus the up line station tunnel has been driven to its full extent, and the down line station tunnel for a distance of 135 lineal yards. A contract for the electrical plant and equipment has been entered into with the British Thomson-Houston Company, Limited, and the generating station is in course of construction on land abutting on the Regent's Canal. Generally, the progress made during the six months is satisfactory. The Bill which the company is introducing into Parliament to extend the time for completion of the line, for further capital powers and for the extension of the line to Lothbury, will be explained at the special meeting to be held after the general meeting.

Central London Railway Company.

THE report for the half-year ended December 31st, 1901, to be submitted to the meeting to be held on 5th prox., states that the amount expended on capital account during the half-year has been £146,724. The receipts from all sources on revenue account have amounted to £168,359, and the working expenses to £90,544 (being 53·78 per cent. of the receipts), leaving a balance of £77,814. The number of passengers carried since the opening of the railway is as follows:—Five months ending December 31st, 1900, 14,916,922; half-year ended June 30th, 1901, 20,385,739; and half-year ended 31st ult., 20,802,650—a total of 56,105,311. The traffic continues to progress steadily and satisfactorily. During the last half-year the average number carried per month was 3,467,108, as compared with 2,983,384 per month for the five months ended December, 1900. After providing for interest on debenture stock, the net revenue account shows a balance of £82,774, including £18,432 brought forward (£9,900 of which was a reserve for dividend on the deferred ordinary stock, which is payable yearly). The directors propose a dividend on the undivided ordinary stock at the rate of 4 per cent. per annum for the half-year; a dividend on the preferred ordinary stock at the rate of 4 per cent.; a dividend on the deferred ordinary stock at the rate of 4 per cent. for the whole year; to transfer £10,000 to a reserve fund, leaving £5,874 to be carried forward. The No. 2 Bill, promoted in last session of Parliament, providing for the acquisition of land to enable the company to construct additional lifts at Shepherd's Bush Station, and to authorise the raising of £150,000 share capital with £50,000 borrowing powers, received the Royal assent on August 5th last. The proprietors will be asked at a special meeting, to be held at the conclusion of the ordinary meeting, to pass a resolution authorising the directors to create and issue the share capital and to exercise the borrowing powers authorised by that Act. The Bill No. 1, providing for the construction of loop lines at Shepherd's Bush and at the City, by way of Liverpool Street, was suspended in common with other electric railway Bills. After careful consideration of the whole position, the directors have decided to abandon the suspended Bill, and to promote in lieu thereof a Bill to construct a new line from Hammersmith to the City. The line as submitted to Parliament will be a continuation of the present Central London Railway, with which it will be connected at its eastern end by a curve serving Liverpool Street and at the western end by a curve from Hammersmith to Shepherd's Bush. This proposal is in harmony with the views expressed on the subject by the Joint Committee on London Underground Railways in their recent report. The convenience which such a railway will afford to the enormous traffic passing along the busy and important thoroughfares of Fleet Street, the Strand, Piccadilly, &c., will be very great, and a remunerative return for the outlay will, no doubt, be secured. As the whole line will be worked as a circle, delays attending shunting operations at the termini, as at present, will be avoided. The provision of a more rapid service, together with a larger number of trains, will become practicable, thus giving ample accommodation for the growing traffic along the route above indicated, and affording much needed relief in the crowded streets. This Bill will be submitted to the proprietors at the Wharncliffe meeting, to be held after the ordinary meeting.

Waterloo and City Railway Company.

THE report of the directors for the half-year ended December 31st last, to be submitted to the meeting on the 6th prox., states that the capital account shows a total outlay of £599,201 on December 31st last. The gross receipts of the line, less Government duty, amounted to £16,678, and the working expenses to £7,589, being at the rate of 45·50 per cent. The balance is sufficient, after providing for interest on the debenture stock, to pay a dividend at the rate of 3 per cent. per annum on the ordinary stock. The number of passengers carried during the past six months, exclusive of season ticket holders, was 2,190,532, showing an increase of 152,132 over the number carried in the corresponding period of 1900. The season ticket holders on December 31st last numbered 1,030, as against 883 at the end of December, 1900. Several underground railway schemes, some of which may affect this railway, will be considered by Parliament in the present year, and these will be carefully watched in the interests of the company.

Eastern Telegraph Company.

THE report of the directors for the half-year ended September 30th last, presented to the meeting on Wednesday, 29th inst., states that the revenue for the period amounted to £603,640, from which are deducted £142,638 for the ordinary expenses and £49,314 for expenditure relating to repairs and renewals of cables, &c., during the half-year. After providing £6,647 for depreciation of spare cable, £263 due to sundry differences in exchange, and £10,087 for income-tax, there remains a balance of £394,698, to which is added £3,226 brought from the preceding half-year, making a total available balance of £397,924. From this balance there has been paid interest on mortgage debenture stock, £29,605; dividends on preference stock, £33,786; and two interim dividends of 1¼ per cent. each on the ordinary stock, £100,000. After carrying £10,000 to the reserve fund for maintenance of ships and £200,000 to the general reserve fund there remains a balance of £24,533, which is carried forward. The revenue includes £23,026 dividends for the half-year upon the company's investments in other telegraph companies. The cables laid by the Eastern Extension, Australasia and China Telegraph Company beween Mauritius and West Australia *vid* Rodrigues and Cocos, were opened for traffic on November 1st

August, 1900, to December 31st last, and show that 20,677 shares four months in 1900 as against the full half year in 1901. The pay-

last, when large reductions were made in the tariffs between Great Britain and East Africa and Mauritius and also between South and East Africa and Mauritius and Australasia. On the 1st inst. the tariffs from Great Britian and Europe to South and East Africa, Mauritius and the contracting States of Australia and *vice versâ* were reduced from 3s. 6d. to 3s. per word under the agreements for "Standard Revenue," entered into with the Governments of Great Britain, Cape Colony, Natal, South and West Australia, New South Wales and Tasmania. It is expected that the cable between Perth and Adelaide will be completed and open for traffic by the end of February next. This section completes the new cable route between Great Britain and Australasia *viâ* South Africa.

The fifty-ninth half-yearly ordinary general meeting of the above company was held on Wednesday at Winchester House, under the chairmanship of Sir John Wolfe-Barry, K.C.B.

In moving the adoption of the report, the CHAIRMAN said the gross revenue for the half-year was £604,000, as against £642,000 in the corresponding period, but they must remember that they were comparing that half-year with the period when they had the largest record revenue of the company since its formation. The large receipts in 1900 were due to the war in South Africa and the military operations in China, but they were now looking forward to the termination of hostilities in South Africa and a great revival in trade, of which they already saw some signs, as there had been a considerable amount of traffic between this country and Johannesburg. They were also looking forward to a reduction of the rates with India. The company had for a long time expressed their willingness to co-operate with those who, to some extent, held the key of the position, and it was only quite lately they had seen daylight; they had every expectation of the rate being lowered, and they hoped before long the rate would be lowered between Europe and India to 2s. 6d. a word. In consequence of the direct cable communication between South Africa and Australia they had made some reduction in the rates to Mauritius and in the local traffic. They looked to get an increase in the traffic, and had, at any rate, been highly congratulated by those who represented the colonies. The working expenses for the half-year were £142,000 as against £131,000 in 1900, but a great deal of the increase was automatic. They could not continue to extend their business without further expense, and the salaries and wages of the staff rose as years went on. Some of the increase was due to the maintenance of the instruments, and improvements were constantly being made, and whenever they were satisfied that an improvement was made they adopted it. There was an increase of £4,000 in repairs and renewals of cables, but that again was accounted for by the increase in the cable mileage. The whole result of the half-year might be summarised as follows:—After charging all expenses, providing for interest on preference and debenture stocks, and paying the usual interim dividends at the rate of 5 per cent. per annum, they were able to place £200,000 to the general reserve, and carry forward £24,000. While that was not quite so good as in 1900, he had no doubt they would consider it satisfactory. In the corresponding period of last year they carried £250,000 to reserve, but the contribution they made that day was by no means an unsubstantial one. In view of their great undertakings, however, he did not think it was too much, and he believed the shareholders would feel with him that the fundamental backbone of the company was the strong financial position, as evidenced by their reserves. During the last 2½ years they had considered it advisable for the company to lay upwards of 10,000 knots of cable, incurring a liability of about £2,000,000. In view of the additional number of words to be dealt with by the growth of the business and the automatic reduction in tariffs, which were stipulated in the agreements with the Home and Colonial Governments, it was advisable to increase their carrying capacity. That had been done so far without any material addition to capital, and these things not only strengthened them in earning power, but rendered an additional security to their whole undertaking. He did not know of any commercial company in the world which seemed so sound as the Eastern Telegraph Company. Having dealt with the affairs of the company, the chairman proceeded to touch on the subject of wireless telegraphy. He said:—

"You may not improbably look for some words from me on wireless telegraphy. It is not so much whether wireless telegraphy has suddenly enlarged its horizon from a distance of 150 or 200 miles under favourable conditions to a distance of 1,850 nautical miles, but whether, granted that it has done so, we, whose money is invested in cable companies, have any reason to fear for our investments. We have told you on former occasions that we did not fear any competition by wireless telegraphy, but, on the other hand, thought that it might be, in special places, an adjunct or handmaid to submarine cables. I will say at once that in these respects we see no reason to alter our opinions. The essential condition of an efficient telegraphic system are speed of transmission, avoidance of error, secrecy and trustworthiness under all circumstances of climate, locality, and natural electrical conditions. With regard to speed, wireless telegraphy, even for most moderate distances, is hopelessly behind the speed of cables. With regard to accuracy of transmission, the cable system must certainly hold the field. Even with very skilful operators the wireless system is liable to electric disturbances from which the cable system is almost entirely free. The postulate of secrecy we are able to ensure by submarine cables, but the case is very different with wireless telegraphy. Even if the tuning could be carried out, there appears to be nothing to prevent anyone desirous of so doing from tuning another receiver by a system of trial and error until he could intercept the message. The board have never felt any fear of the competition of wireless telegraphy with our cable systems, and have merely looked upon it as a useful system for such matters as signalling between ships or for employment in a position where, for other reasons, a cable cannot be satisfactorily used. As a matter of fact, we have in our eye at this moment a station of our own where we are making inquiries with a view of thoroughly studying the possibility and economy of erecting a wireless telegraphic adjunct of our system for about 100 miles. At the present time I am unable to say whether we shall adopt it or not, but we are investigating the pros and cons, because in this particular situation there are disadvantages in the use of a cable. But as the main question affects a very large capital, and it might be thought that our judgment and that of our highly skilled staff may be warped and prejudiced by our position, the directors thought that the stockholders would like to know what were the opinions of those outside our companies who were best qualified to give opinions on a subject which has been in a special way their own. The gentlemen whom we selected for advice are Prof. Oliver Lodge and Sir William Preece, both of whom are known to the world at large, and particularly to the world of science, as having been engaged in the development of wireless telegraphy for very many years. Prof. Oliver Lodge holds the American patent, only granted by that nation after exhaustive inquiry, for the system to the first and true inventor—and he is interested, with Dr. Muirhead, in its commercial development. Sir William Preece, who succeeded in bridging the Solent by its means in 1882, was the first to use wireless telegraphy for ordinary messages in 1892. Both gentlemen have furnished us with independent and carefully-written reports dealing with the whole subject in answer to our questions. They completely bear out the conclusions to which we had arrived. They point out that wireless telegraphy, as now understood, labours under inherent and inseparable disadvantages compared with cable transmission, which must, whatever improvements may be made in years to come, prevent it from being anything more than an inferior mode of transmission, even over comparatively short distances. These inherent disadvantages are slowness, confusion of message, want of secrecy, liability to interruption. After fully discussing future possible improvements, Dr. Oliver Lodge sums up the situation as follows:—'The chief conclusions to which I have arrived are the following: If the question means, Is there any yet known form of apparatus, or any already invented appliance, which would interfere with the pre-eminence of submarine cables if put into use, I should say certainly not. To the best of my belief submarine cables will for a long time be pre-eminent for the purpose of long-distance telegraphy. It is manifest that wireless or open methods cannot compete in point of secrecy and certainty with closed or cable methods, and could only compete with them in point of speed and accuracy by aid of great improvements and new inventions involving little less than discoveries.' In a similar way, Sir William Preece points out the slowness of the method, and states that, after allowing for staff service words and corrections of signals, he doubts the possibility of sending more than two or three paying words per minute across the Atlantic, even if the system could be made to work, of which at present no evidence has been produced. He also points out the extreme difficulty of any system of tuning between the transmitting and receiving instruments, so as to avoid, at any rate, some portion of the risk of the messages being tapped. He informs us that even for moderate distances, where wireless messages pass from ship to ship, the whole system has been liable to complete disturbances by atmospheric or natural electrical causes, so that the system is occasionally practically unworkable for considerable periods. After indicating the very serious defects under which wireless telegraphy labours, he summarises the present position as follows:—'All these causes of disturbance, which may or may not be remedial in the future, are at present existent and fatal to the establishment of a practical and reliable ætheric system of commercial telegraphy. I am, therefore, very clearly of opinion that submarine cable enterprise has nothing to fear, in a commercial sense, from the competition of ætheric telegraphy.' Undoubtedly there has been a kind of modified scare among some nervous stockholders, but, as a matter of fact, this feeling has been greatly circumscribed, and the number of transfers which have passed through the office indicate that very few have been affected by the fear of wireless telegraphy. I am happy, also, to see that the recent prices in the money market of our shares indicate that any alarm, such as it was, is passing away. No one, of course, would be so rash as to put any limits to the possibilities of science, and, least of all, should I like to do so. On the other hand, in these matters we must consider, not the possibilities, but the probabilities of the case. In the case of wireless telegraphy, we have a system which has fundamental and, to my mind, irremediable disadvantages. In regard to telegraphy by submarine cables, we have a thoroughly efficient system, which fulfils all that is required from it."

The report was adopted.

Horsfall Destructor Company.

THE report of the directors for the year ended October 31st last, submitted at the meeting held yesterday, states that a small profit has been realised on the year's trading. The directors trust that the company has now passed through the difficulties experienced at its commencement by the enormous advances in materials referred to in their last report. The gross profit for the year under review is greater than for the previous two years, while the general expenses are very much less. The present year has commenced with a good amount of orders in hand, and the demand for their furnaces is steadily increasing. In conclusion, the directors are pleased to state that the reputation of the Horsfall furnaces has steadily gained ground, not only in this country, but throughout Europe.

general meeting.

vid Rodrigues and Cocos, were opened for traffic on November 1st

City and South London Railway Company.

MR. C. G. MOTT presided at the meeting of this company held at the offices on Tuesday, and in proceeding to move the adoption of the report, he referred at some length to the general question of accidents on underground electric railways. He called attention to the fact that again this half-year they had carried a large number of passengers in perfect safety. They were aware that some alarm about such lines was created by an unfortunate fire or occurrence at the terminal station of the Liverpool Overhead Railway. It raised questions in the newspapers and elsewhere as to the safety of the London underground electric railways. If they considered the past experience of this railway, they would see how utterly unfounded were any ideas of there being any practical danger connected with the working of their line. They had been open for between 11 and 12 years, and had carried very nearly 100 millions of passengers, and had not seriously injured any of them. The number of actual separate trains run during that time considerably exceeded 1½ millions. All those trains ran with perfect safety, and he thought that there was no other railway which could show such immunity from accident or injury to its passengers. In the case of Liverpool, the mode of working the trains was different, the motors being placed underneath the train, part at one end and part at the other, both under the control of an engine driver, who was situated only at the front of the train, so that he knew nothing of what was going on at the rear. This was the primary cause of the Liverpool accident, the engine driver not knowing that he was creating, and continuing to create, by his own action a fire at the rear. On the City and South London Railway the motors were placed on a separate isolated iron-framed engine, not on the carriages, and they were both absolutely under the control of the driver, and whatever went wrong he knew what it was, and could act at once. Short circuits they could not avoid, but this only caused a stoppage of the current for the moment, and the delay of the train; any small burning of insulation could be put out in a moment. They had recently the very worst occurrence they could possibly have on their locomotives. It was a short circuit of a peculiar character, which became too large before he knew it for the driver to extinguish it at once, and it burnt out the interior of the engine. There was a delay of a little over an hour, but no one was burnt, under the most adverse circumstances that could possibly have occurred. It showed the safety of the system. They were perfectly satisfied that there was no risk to passengers, but they had thought, in view of the public alarm, that it was best to make security doubly sure, and they were putting on a number of additional appliances, which would, in the first place, reduce the time of any stoppage which might occur, and also make it absolutely certain that no damage could possibly occur. They were putting on each of the locomotives a special extincteur, with which the driver could put out any fire at once. They were putting up wires, by which the engine driver, wherever he might be stopped, could communicate instantly with the stations. They were putting extra water mains on the stations on the old line—they had them on the new—with very powerful hose attached, so that in any case of fire on the train or station, they would be prepared to deal with it in a most effective manner. They also proposed to light the whole of the tunnels by electricity. At present, when a short circuit occurred, it sometimes happened that the whole of the lights in the trains went out. The auxiliary oil lights only gave a comparatively small light in emergencies, and in all these cases the electric light would now be immediately turned on, and the whole tunnel illuminated. They also had a perfect wood path from end to end, along which passengers could walk. Turning now to the accounts, the chairman said that the receipts amounted to £62,601, against £46,740 in the previous corresponding half-year, increase £15,861. Of this increase £15,020 was due to passengers. The expenses were £29,257, as against £26,280; increase, £2,977. The net increase was £12,828. Of this £5,768 was available for dividend, which allowed for 2¼ per cent. per annum on the ordinary stock for the half-year, against 1¼ per cent. for the corresponding half in the previous year, and the balance carried was increased by £200. The train miles run during the half-year were 495,106, against 383,670, increase 111,436; that was due partly to more trains being run, but chiefly to the opening of the Islington extension. The number of trains run was 97,445, against 80,437, increase 17,000. The working expenses were reduced to the most satisfactory figure of 46·74 per cent.; that showed what he had always contended for, that as the traffic increased, the value and advantages of working by electricity were clearly shown. Out of that percentage about 8 per cent. was due to the working of the lifts, which reduced the actual working expenses of the railway to something like 38 or 39 per cent. The last half-year he reported the reduction of the expenses to 52·36, and they thought they had got down to a very satisfactory figure then, but the opening of the Islington line, and the general growth of the traffic, was clearly shown in the decrease of the percentage of working expenses, and he had very little doubt that they would still further reduce the figure as the line grew. The receipts per train run had risen from 11s. 6 88d. to 12s. 3d. The receipts per train mile were as nearly as possible the same as in the corresponding period; they had run a very large amount of additional train mileage, and had been able to do that without diminishing the receipts per train mile, that was to say, that the number of passengers had increased sufficiently to cover all the train mileage and the increase in it. The expenses per train mile in the corresponding period last year were 1s. 4·44d., and this half year they were 1s. 2 28d., a most satisfactory figure. The locomotive charges (electric power) in the last half year were 5·50d. per train mile, and they were now reduced to 4·58d. The general traffic expenses had been reduced from 7 72d. to 6·29d. All those percentages were undoubtedly very satisfactory features in the whole thing. The increase in passengers carried was shown in the report which appeared in the ELECTRICAL REVIEW last week. That increase was partly due to the Islington extension, but prior to the opening of that section, the traffic was steadily growing and showed a considerable increase. Since that opening the increase had been greatly accelerated, and was going on in a very satisfactory way. He hoped that when they met again he would have some still more satisfactory dividends than hitherto to refer to. The arrangements made between this company and the City & Brixton Railway were among the other matters touched upon by the chairman. This company found that the trains coming in from Clapham, now frequently arrived at London Bridge so full up that it was difficult for passengers coming from the Brighton Railway to get seats in the trains. This was hardly keeping faith with the Brighton Railway, and they must do something to enable them to deal with the traffic which had increased, as the result of the opening of the London Bridge subway; they must provide some means for bringing those passengers into the city. They had to do it now by keeping back passengers from Clapham and the stations between, and so leaving room in the trains. They had, therefore, arranged with the City & Brixton Railway to make only a short portion of the line down to Lambeth, the City & South London disused line from London Bridge to the Monument being used at this end. The simple arrangement with the Brixton Company was that they should raise the money to carry the line on as far as Lambeth, their line thus being about twice as long as the disused tunnel, the Brixton Company also making a new station at London Bridge for this company, whose property it would be. They would put the disused tunnel into good order, and give this company sufficient money to provide for the new engines and the power that might be required for working the line. The Brixton Company would have a first charge over the gross earnings of the line of £10,500 a year (3 per cent. on the estimated expenditure), and following upon that the next charge upon the gross receipts would be this company's working expenses, £10,500, that charge being a cumulative one. It was believed that the traffic would be far larger than would be sufficient to pay both of those amounts. Then the arrangement of division was that the C. & S.L. should receive three-fourths over and above those two amounts, and that the Brixton Company should receive one-fourth. There would be no guarantee or charge upon the C. & S.L. at all, and it would have nothing whatever to do with guaranteeing anything upon its capital. All that they ran the risk of was, that if the traffic proved very small, they might have to wait a little while before getting their full working expenses. They would thus get what they wanted without any practical charge upon the company. The improvement of the new rolling stock, the unlikelihood of the St. Mary Woolnoth arbitration coming to an end in a hurry, and the Islington and Euston Bill, which was to be constructed by a separate company but worked by this company, were matters briefly touched upon.

The adoption of the report was seconded by Mr. GRENFELL, and after a number of questions had been asked by shareholders, and answered in his usual very lucid and satisfactory way by the chairman, the resolution was unanimously passed.

The dividend resolutions were carried, as were also resolutions re-electing a director and auditor.

A special meeting was then held, at which it was resolved that the existing issue of ordinary shares be converted into consolidated ordinary stock.

At a subsequent Wharncliffe meeting the agreement with the City and Brixton Railway Company was explained and approved.

Anglo-American Telegraph Company.—The directors have resolved, after placing the sum of £12,000 to the credit of the renewal fund for the half-year, to recommend to the proprietors at the next ordinary general meeting of the company to be held on February 7th next, the declaration of the following dividends:—

1. A balance dividend of 16s. per cent. upon the ordinary consolidated stock for the year ending December 31st, 1901.
2. A balance dividend of £1 10s. per cent. upon the preferred stock for the year ending December 31st, 1901.
3. A first and final dividend of 2s. per cent. upon the deferred stock for the year ending December 31st, 1901, all payable on February 8th next, less income-tax, to the stockholders registered on the books of the company on January 10th.

This leaves a balance of about £1,265 to be carried forward to the next account. The above dividends, together with those already paid, will amount to £3 1s. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and 2s. per cent. on the deferred stock for the year 1901.

Stock Exchange Notices.—The committee have been asked to allow the following to be quoted in the Official List:—

National Telephone Company—Further issue of £100,000 4 per cent. debenture stock (redeemable).

The committee has appointed a special settling day as under:—Wednesday, February 5th.—Perth Electric Tramways, Ltd. (W.A.).—£150,000 5 per cent. first mortgage debenture stock; and has ordered same to be quoted in the Official List.

Liverpool Overhead Railway Company.—The accounts of this company for the past half-year show an available balance of £12,192, and the directors have resolved, after setting aside £3,000 to meet contingencies in connection with the accident at Dingle Station, to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares, and 1 per cent. per annum on the ordinary shares. Balance carried forward, £3,692.

Newcastle Electric Supply Company.—Dr. Merz presided over an extraordinary general meeting of shareholders at Newcastle on 23rd inst., to sanction the promotion of a Bill in Parliament to secure further powers for the construction of works and the supply of electrical energy and other purposes. Dr. Spence Watson, the legal adviser, having explained the matter, the resolution was carried.

Company Notice.—It is announced that unless cause is shown to the contrary the name of the United Kingdom Electric Telegraph Company is to be struck off the register within three months.

British Electric Traction Company.—The directors have decided to pay the dividend on £1,000,000 6 per cent. cumulative preference shares for the half-year to 15th prox.

Waterloo and City Railway Company.—The directors recommend a dividend on the ordinary stock at the rate of 3 per cent. per annum for the half-year ended December 31st.

Westminster Electric Supply Corporation.—The directors recommend a dividend for the half-year ended December 31st at the rate of 11 per cent. per annum, less tax.

TRAFFIC RECEIPTS.

Blackburn Corporation Tramways.—The receipts for the week ending Jan 24th were £611; corresponding week last year, £534; increase, £77. Total to date, £2,186; corresponding period last year, £1,905; increase £281. Miles of track open, 10¾.

Blackpool and Fleetwood Tramways.—The receipts for the week ending January 25th were £161; corresponding week last year, £141 decrease, £20. Total receipts to date, £585; corresponding period last year, £532; increase, £53.

Bristol Tramways and Carriage Company.—The receipts for the week ending January 24th were £3,960; corresponding period last year £3,854; increase, £106.

Central London Railway.—The receipts for the week ending Jan. 25th were £6,615; corresponding week last year, £5,961; increase, £654. Total receipts to date, £26,195; corresponding period last year, £23,46 ; increase £2,729. Miles open, 6.

British Electric Traction Company.—The following returns are issued of the undertakings of this company for the week ending January 17th:—

Company.	Amount £	Comparison with corresponding week of last year. + £	Comparison with corresponding week of last year. — £	No. of weeks.	Aggregate. Amount. £	Aggregate. Inc. or Dec. + £	Aggregate. Inc. or Dec. — £
Croydon*	629	381	—	2½	1,516	936	—
Devonport	399	—	—	2½	993	—	—
Dudley—Stourbridge	599	111	—	2½	1,432	277	—
Gateshead	587	—	—	2½	1,494	—	—
Greenock-Pt. Glasgow	300	148	—	2½	866	422	—
Hartlepool	157	—	4	2½	420	22	—
Kidderminster ..	91	13	—	2½	217	22	—
Merthyr	176	—	—	2½	422	—	—
Oldham—Ashton ..	437	—	91	2½	1,094	—	78
Poole	179	—	—	2½	438	—	—
Potteries	1,349	57	—	2½	3,175	—	7
Southport	113	19	—	2½	290	28	—
South Staffordshire†	689	37	—	2½	1,683	96	—
Swansea	375	17	—	2½	949	58	—
Taunton	47	—	—	2½	126	—	—
Tynemouth	170	—	—	2½	454	—	—
Wolverhampton Dist.	128	86	—	2½	340	189	—

* Partly horse. † Partly steam.

The aggregate receipts to date are for 17 days this year, as against 18 days last year.

City and South London Railway.—The receipts for the week ending Jan. 26th were £2,909; corresponding week last year, £1,975; increase, £934. Total receipts to date (4 weeks), £12,056; corresponding period last year, £8,048; increase, £4,008. Miles open, 6¼; last year, 4¼.

Dover Corporation Tramways.—The receipts for the week ending January 25th were £170 13s. 1d.; corresponding week last year, £169 19s. 6½d.; increase, 13s. 6½d. Total to date, £648 15s. 1d.; corresponding period last year, £635 4s. 10½d.; increase. £13 10s. 2½d. Miles of track open, 3. Car miles run, 1902, 5,100; 1901, 4,978. Number of cars, 1902, 12; 1901, 11.

Dublin United Tramways Company.—The receipts for the week ending January 24th were as follows:—D.U.T. Co., £3,342 19s. 8d.; D.S.D. Co., £701 0s. 8d.; total, £4,044 0s. 4d.; corresponding week last year—D.U.T. Co., £3,202 8s. 1d.; D.S.D. Co., £654 4s. 4d.; total, £3,856 12s. 5d.; increase, £187 7s. 11d.; aggregate to date, £14,333 10s. 6d.; last year, £13,612 1s. 11d.; increase, £721 8s. 7d. Mileage worked, 46.

Liverpool Overhead Railway.—The receipts for the week ending January 26th were £1,343; corresponding week last year, £1,457; decrease, £114. Total to date, £5,595; corresponding period last year, £5,994; decrease £399. Miles open, 6 miles 57 chains; last year, 2 miles 40 chains.

STOCKS AND SHARES.

Wednesday Evening.

THE outstanding feature in our markets this week is the recovery that has taken place in telegraph stocks and shares. It was, of course, inevitable that a reaction should come after the recent jump, but the improvement tarried longer in its coming than was generally expected. However, our list of telegraph securities this week exhibits a whole series of rises, and there is only a brace of falls to record in the forty-four prices which we quote. The attention of the general markets of the Stock Exchange is so much taken up with the boom in Kaffir shares that there really remains very little interest for anything else, and it may readily be conjectured that the telegraph recovery is taking place with but a small amount of business to help it. Investment departments are fairly steady on the whole, but they have no charm as compared with the speculative sections. In fact, if the boom in South Africans continues much longer, it would not be astonishing to see a slight lowering of values in the Electricity Supply market, since bounding animation in mines or Americans frequently leads to an easing off in the more sober walks of the Stock Exchange.

The half-yearly report of the Central London Railway provides very satisfactory reading for the proprietors. Perhaps the most interesting item in the document, after the steadily increasing character of the traffic receipts, is the lessening of the proportion of working expenses. It may be remembered that there was a good deal of disappointment when the proportion of expenses to receipts was announced at 58¾ per cent. for the first five months ending December 31st, 1900. This has now been reduced to 53⅞ per cent., and it may be reasonably hoped that the figure will be lowered to something more nearly approaching the 50 per cent., which was the original maximum estimate. The board have given up several of their former suggestions in favour of a new line to be made from Hammersmith to Liverpool Street, *viâ* Piccadilly and the Strand. The report of the Central London directors forms, incidentally, about as severe an indictment of the policy pursued by the two wrangling Undergrounds as could be imagined. The Preferred stock of the "Twopenny Tube" looks an attractive investment. City & South London securities are unchanged, the meeting on Tuesday eliciting no fresh points of importance. The chairman, in alluding to the accident on the Liverpool electric line, said that a number of new appliances were being adopted on the City & South London which would render travelling absolutely safe. It may be mentioned, by the way, that operations in connection with the new mono-rail between Liverpool and Manchester will probably be commenced at Eccles early in April. At last has the Waterloo and City begun to repay some of the past deficiencies to the London and South-Western, and even £104 is better than nothing.

In the Telegraph market, Eastern Ordinary has scored the largest advance with a rise of eight points, although this is really improved upon, in a sense, by Eastern Extension shares, which have gone up £1, equivalent to 10 per cent. on stock. Anglo-American Preferred has smartly risen to 95, while the Ordinary and Deferred are both better. For this, the dividend of 2s. per cent. on the last-named stock is principally responsible, the market having gone for nothing at all on Anglo "A." It must be allowed by the most ardent believer in the company that the dividend on the Deferred is anything but brilliant, and it compares with 5s. this time last year, and 27s. the year before. At the present price, Anglo "A" yields the purchaser a paltry 1¼ per cent. on his money. The better tone in the telegraph market finds a natural reflection in a further improvement by Globe Telegraph and Trust shares. Both the Ordinary and Preference have advanced another 5s. each. Great Northern Telegraph shares are 10s. up, and Direct United States are also better. West African Telegraph shares are 2 middle. The Committee on Commerce in the American House of Representatives has decided in favour of a new Government Pacific cable, to be supplied, if possible, by Yankee makers..

National Telephone Ordinary shares hardened upon the debate in the House of Commons on Monday night, which went to show that the arrangement between the Government and the company would be maintained. The senior issues are, however, unaltered. Orientals have given way to the extent of 1s.

British Electric Traction Preference shares are finding supporters, but the Ordinary do not move. Cape Electrics are a good market at 2⅛, and Anglo-Argentine trams are steady at 4½. The Isle of Man Tramways and Electric Power Company has been sold, as regards the greater part of the electrified line, for £252,000 to Mr. Schenk, chairman of the Crystal Palace, mention of which naturally leads to noticing the progress that is being made in the scheme for constructing an electric line between the City and Sydenham.

In the electric supply section almost the only quotable change is a rise of ¼ in Brompton and Kensington Ordinary and Preference. All dealings have now ceased in the Westminster fractions, and the price of the old shares may improve. New Chelseas are 5½, which is ¼ under the price of the old. There has been some inquiry for London Electric Preference in the neighbourhood of 4½.

British Insulated Wire are again better upon those amalgamation rumours to which we referred last week. Callender's Preference have given way a trifle, and sellers of India-Rubber shares have come along, causing the price to lose the 10s. which it gained last week. The Sussmann Electric Miners' Lamp report is a doleful document, and voluntary liquidation appears to be the best course for the unfortunate shareholders to adopt.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotations Jan. 22nd.	Closing Quotation Jan. 29th.	Business done during week ended Jan. 29th. 1902 Highest.	Lowest.
£2,300	African Direct Telegraph, 4 % Debs	100	...	...	...	97 —101	99 —103	...	...
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000 ...	10	...	...	...	3½— 4½	3½— 4½	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red. ...	100	...	...	...	70 — 80	70 — 80	...	...
804,720	Anglo-American Telegraph	Stock	73/6	3½%	61s.	48 — 50	50 — 52	50	..
3,097,640	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	90 — 92	94½ — 95½	95⅜	91
3,097,640	Do. do. Deferred	Stock	£1 7s.	5s. %	2s.	7⅞— 8¼	8 — 8½	8⅜	7⅞
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	5 %	...	3½— 4	3½— 4	...	...
13,333,300$	Commercial Cable	$100	8 %	...	...	165 —170	165 —170	...	...
1,741,029£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	92 — 96	90 — 95	94	92
16,000	Cuba Telegraph	10	7 %	...	...	5 — 6	5 — 6	...	...
6,000	Do. 10 % Pref.	10	...	...	...	13 — 14	13 — 14	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	3 — 4	3 — 4	...	...
6,000	Do. do. 10 % Cum. Pref.	5	...	...	...	8½— 9½	8½— 9½	...	...
30,000£	Do. do. 4½ % Debs.	50	...	...	...	98 —102	98 —102	...	...
60,710£	Direct United States Cable	20	3½%	3¼%	...	9½— 10 xd	9¾— 10¼	10¼	9⅞
101,300	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	99 —102	99 —102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	...	124 —129	132 —137	133⅛	128½
1,930,807	Do. 3½ % Pref. Stock	100	...	...	...	88 — 90	89 — 91	90	...
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	108 —112	109 —113	...	...
300,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	...	12½— 12¾xd	13¼— 13¾	13¼	12⅝
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	108 —113	109 —114	...	..
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	5¼%	...	...	100 —103	100 —103	100	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103	100 —103 %	...	...
180,227	Globe Telegraph and Trust	10	5¼%	5¼%	...	9¼ — 9¾	9⅝— 10	9⅝	9⅜
180,042	Do. do. 6 % Pref.	10	...	...	...	13½— 13¾	13½ — 14	13⅞	13 9/16
150,000	Great Northern Telegraph, of Copenhagen	10	...	15 %	...	27½— 28½	28 — 29	...	...
75,000	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —103	99 —103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	...	38 — 42	38 — 42	...	...
100,000£	London Platino-Brasilian Telegraph, 6 % Debs.	100	...	...	...	102 —105	102 —105	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	2½%	...	...	¼— ½	¼— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	5 %	...	...	¾— 1	¾— 1	...	...
590,000	National Telephone, 1 to 590,000	5	5 %	5 %	...	3⅜— 3⅝	3⅜— 3⅞	3⅝	3¾
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	...	11 — 13	11 — 13	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	...	11 — 13	11 — 13	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	...	4¾— 5	4¾— 5	4¾	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	...	94 — 97	94 — 97	96¼	95¾
500,000£	Do. 4 % Deb. Stock Red....	100	...	4 %	...	101 —105	101 —105	103½	...
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	6 %	...	5/16— 1 1/16	⅞—1	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	...	...	...	99 —102	99 —102	...	...
11,839	Reuter's...	8	5 %	5 %	...	7 — 8	7 — 8	...	...
3,303	Submarine Cables Trust	Cert.	...	...	...	117 —121	117 —123	118½	118
58,000	United River Plate Telephone	5	7 %	...	...	4¾— 5¼	4¾— 5¼	...	...
40,006	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4½— 5	4½— 5	...	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	102 —105	102 —105	...	...
155,600	West African Telegraph, 5 % Debs....	100	...	...	...	100 —103	100 —103	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	⅛ - ⅜	⅛ — ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Bras. Sub. Tel.	100	...	...	...	99 —102	99 —102	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	12¼— 12¾	12¾— 13¼	13 1/16	12⅝
75,000£	Do do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	102 —105	102 —105	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	101 —104	101 —104	...	...
88,321	West India and Panama Telegraph	10	5%	...	...	½— ⅝	½— ⅝	½	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	...	...	...	5 — 6	5 — 6	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	...	...	...	3 — 4	3 — 4	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	...	...	...	102 —105	100 —103	...	...

ELECTRICITY SUPPLY COMPANIES.

100,000	Blackheath and Greenwich Dist. Electric Light, Ord. ...	1	...	...	...	⅜— ⅝	⅜— ⅝	...	...
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs.	100	...	...	...	97 — 102	97 —102	...	...
19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	...	8¾— 9¼	9 — 9½	...	...
20,000	Do. do. 7 % Cum. Pref....	5	...	...	...	8¾— 9¼	9 — 9⅛	...	...
50,000	Charing Cross and Strand Electricity Supply	5	9 %	9 %	...	8 — 9	8 — 9	8⅜	8⅛
50,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5 — 5½	5 — 5½	...	...
250,000	Do. do. do. 4% Deb. Stock Red.	100	...	...	...	103 —105	103 —105	...	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	5½%	...	5½— 6	5½— 6	...	...
150,000£	Do. do. do. % Deb. Stock Red. ...	Stock	...	...	...	108 —111 xd	104 —111	...	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579...	10	4 %	0 %	...	9 — 10	9 — 10	9⅛	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	12 — 13	12 — 13	...	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	121 —126	121 —126	...	...
200,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	...	...	...	101 —104	101 —104	...	..
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	4 %	4 %	...	8½— 9½	8½— 9½	9¾	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	12 — 13	12 — 13	...	...
400,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	..	105 —108	105 —108	106¾	106½
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	7 %	...	5½— 6	5½— 6	5 1/16	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	5½— 6	5½— 6	...	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	...	106 —109	105 —108	...	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	...	...	...	11 — 12	11 — 12	...	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	103 —106	103 —106	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1½— 1⅝	1½— 1⅝	...	...
49,840	Do. do. do. do. 6 % Pref.	5	...	...	...	4 — 5	4 — 5	4⅝	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	95 —100	95 —100	...	...
98,769	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	...	14½— 15½	14½— 15½	14 15/16	...
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	111 —115	111 —115	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	96 — 99	96 — 99	...	...
8,652	Notting Hill Electric Lighting	10	7 %	7 %	..	15 — 16	15 — 16	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	15½— 16½	15½— 16½	...	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	...	8½— 9½	8½— 9½	...	...
150,000£	Do. do. 3½ % Deb. Stock Red. ...	100	...	...	...	97 —100	97 —100	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	2 — 2½	2 — 2½	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90	80 — 90	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2 — 2½	2 — 2½	...	...
109,518	Westminster Electric Supply, Ord.	5	13 %	10½%	...	12 — 13	12 — 13	12 1/16	...

* Subject to Founders Shares.
† Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid.
§ Dividends paid in deferred share warrants, profits being used as capital.
¿Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation Jan. 22nd.	Closing Quotation Jan. 29th.	Business done week ended Jan. 29th, 1902. Highest	Lowest.
20,000	British Aluminium 7 % Cum. Pref.	£10	...	...	...	4½ — 5½	4½ — 5½	...	...
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	87 — 91	87 — 91	...	...
62,074	British Electric Traction	10	8 %	9 %	...	14 — 15	14 — 15	14⅛	14⅛
90,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12½ — 12⅝	12½ — 13	12⅝	12 9/16
600,000£	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	126 —129	126 —129	128½	128
70,000	British Insulated Wire Ord.	5	20 %	15 %	...	9½ — 10½	10½ — 11⅛	11⅛	10⅝
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	5⅞ — 6¼	5⅞ — 6¼xd	5⅞	...
50,000	¶Browett, Lindley & Co. (1899), Ord.	£1	...	8 %	...	⅞ — 1	⅞ — 1	...	...
50,000	¶ " " " 6 % Cum. Pref.	£1	...	6 %	...	1 5/16 — 1 1/16	1⅛ — 1 1/16	...	...
105,731	Brush Elecl. Enging., Ord., 1 to 105,731	2	5½ %	5 %	...	1⅜ — 1⅝	1⅜ — 1⅝	1½	...
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	...	2 — 2¼	2 — 2¼	...	...
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	102 —105	102 —105	105	...
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	99 —102	97 —100	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	...	16½ — 17½	16½ — 17½	17⅜	16⅞
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5⅜ — 6¼	5½ — 6	...	...
90,000£	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	110 —114	110 —114	...	...
1,969,800	Central London Railway, Ord. Stock	Stock	...	...	4 %	105 — 108	105 — 108	107½	107
440,100	Do. do. 4 % Pref. Stock	Stock	...	...	4 %	105 — 108	105 — 108	107½	...
440,100	Do. do. Def. do.	Stock	...	...	4 %	106 — 109	106 — 109	107¾	107
855,000	City and South London Railway	Stock	1½ %	1½ %	2 %	65 — 67	65 — 67	66½	66
47,500	Do. do. Ord. shares Nos. 22,501 to 70,000	10	...	...	...	6 — 6½	6¼ — 6⅜	...	...
54,000	Crompton & Co., Nos. 1 to 54,000	3	7½ %	8 %	...	3 — 3½	3 — 3½	3 5/16	...
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	99 —104	99 —104	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	2½ %	...	⅛ — ⅜	⅛ — ⅜	3/16	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	2½ %	...	2 — 3	2 — 3	...	...
344,023£	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	78 — 83	78 — 83	...	...
100,000£	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	84 — 89	84 — 89	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	...	1⅜ — 2¼	1⅜ — 2¼	1 1/16	1⅛
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390... ...	2	...	...	...	2½ — 3	2½ — 3	2⅜	1 1/16
182,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	97 —101 xd	97 —101	99¾	...
18,000	General Elec. Co. (1900) 5 % Cum. Pref.	10	...	...	...	9¾ — 10¼	9¾ —10¼	...	...
150,000	Do. do. 4 % Mort. Deb.	Stock	...	...	...	99 — 102	99 —102	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	15 %	20 %	...	16½ — 17½	16½ — 17½	17¼	...
35,000	Do. do. do. 4½ % Pref.	5	4½ %	4½ %	...	5½ — 6	5½ — 6	5 9/16	...
50,000£	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	112 —116	112 —116	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	...	...	20½ — 21½xd	20 — 21	20¾	20⅝
300,000£	Do. do. do. 4 % 1st Mort. Deb ...	100	...	...	...	100 —103	100 —103	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3½ %	3½ %	...	4⅜ — 5	5⅛ — 5⅜	...	...
10,000	† Do. do. Pref., £10 paid	10	5	...	...	11¼ — 11⅜	11¼ — 11⅜	...	...
7,500	Parker (Thomas), Limited, Ord., Nos. 1 to 7,500 ...	10	...	...	...	15½—16½	15½ — 16½	...	...
	§Rosling, Appleby & Fynn 6 % Cum. Pref.	£1	...	6 %	...	19/- to 20/-	... — ...	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	17½ %	...	35 — 38	35 — 38	35½	...
150,000£	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	... %	...	...	102 —104	102 —104	102¾	...
25,000	Telegraph Manufacturing, Ord. Nos. 1 to 25,000	5	12 %	12 %	...	10½ — 11½	10½ — 11½	10¾	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000 ...	5	...	...	...	5½ — 6	5½ — 6	...	...
540,000£	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	91 — 94	91 — 94	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance 2/—4/-
National Electric Free Wiring, 17/6 paid, ½—¾.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 15½—16.
Do. do. Pref. (£10 pd.), 10⅛—10⅜.

* From Birmingham Share List. ¶ From Manchester Share List.

Bank rate of discount 4 per cent. (October 31st, 1901).

MARKET QUOTATIONS, Wednesday, January 29th.

CHEMICALS, &c.	This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	5/-	..
a " Nitric .. .. .. per cwt.	22/-	22/-	..
a " Oxalic .. .. .. per cwt.	32/-	32/-	..
a " Sulphuric .. .. .. per cwt.	5/6	5/6	..
a Ammoniac, Sal .. .. .. per cwt.	89/-	89/-	..
a Ammonia, Muriate (crystal) .. per ton	£33 10	£33 10	..
a " " .. per ton	£30	£30	..
a Bleaching powder .. .. per ton	£7	£7	..
a Bisulphide of Carbon .. .. per ton	£15	£15	..
a Borax .. .. per ton	£13	£13	..
a Benzole (90 %) .. .. .. per gal.	7/-	7/-	..
a " (50/90%).. .. .. per gal.	5/6	5/6	..
a Copper Sulphate .. .. .. per ton	£19 5	£19 5	..
a Lead, Nitrate .. .. .. per ton	£24	£24	..
a " White Sugar .. .. .. per ton	£31	£31	..
a " Peroxide .. .. .. per ton	£27 10	£27 10	..
a Methylated Spirit .. .. .. per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C). per gal.	5/6	5/6	..
a Potash, Bichromate, in casks.. per lb.	8d.	8d.	..
a " Caustic (75/80%) .. per ton	£24	£24	..
a " Bisulphate .. .. per ton	£35	£35	..
a Shellac .. .. per cwt.	125/-	125/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers .. per ton	£6 5	£6 5	..
a " Recovered .. .. per ton	£5 10	£5 10	..
a " Lump .. .. .. per ton	£5	£5	..
a Soda, Caustic (while 70 %) .. per ton	£10 15	£10 15	..
a " Crystals .. .. .. per ton	£8	£8	..
a Bichromate, casks .. per lb.	2¼d.	2¼d.	..

METALS, &c.			
b Aluminium Ingots, in ton lots per ton	£148	£148	..
b " Wire, in ton lots per ton	£224	£224	..
b " Sheet, in ton lots per ton	£191	£191	..
p Babbitt's metal ingots.. .. per ton	£75 to £125	£75 to £125	..
c Brass (rolled metal 9" to 12") basis per lb.	6¼d.	7d.	¾d. dec.
c Tube (brazed) .. .. per lb.	7¾d.	8¾d.	1d. dec.
c " (solid drawn) .. per lb.	6¾d.	7¾d.	1⅛d. dec.
c " Wire, basis .. .. per lb.	6¾d.	7d.	¼d. dec.
c Copper Tubes (brazed) .. per lb.	8½d.	9½d.	1d. dec.
c " " (solid drawn) .. per lb.	8¾d.	9¾d.	1d. dec.
g Copper Bars (best selected) .. per ton	£66	£66	..

METALS, &c. *(continued.)*	This week.	Last week.	Inc. or Dec.
g Copper Sheet .. .. .. per ton	£66	£66	..
g " Rod .. .. per ton	£66	£66	..
e " Electrolytic) Bars .. per ton	£55	£55	..
e " " Sheets .. per ton	£70	£70	..
e " " Rod .. per ton	£63	£63	..
e " " H.C. Wire per lb.	8d.	8d.	..
f Ebonite Rod .. .. per lb.	8/-	8/-	..
f " Sheet .. .. .. per lb.	5/-	5/-	..
n German Silver Wire .. .. per lb.	1/5	1/5	..
h Gutta-percha fine .. .. .. per lb.	8/-	8/-	..
h India-rubber, Para fine .. .. per lb.	3 3	8/4 to 8/5	dec.
i Iron, Charcoal Sheets .. .. per ton	£18	£18	..
i " Pig (Cleveland warrants) .. per ton	44/3	44/10	7d. dec.
i " Forgings, according to size per ton	From £11	From £11	..
i " Scrap, heavy .. .. .. per ton	47/6 to 50/-	47/6 to £0/-	..
i " Wire, galvanised No. 8 .. per ton	£9 10	£9 10	..
g Lead, English Ingot .. .. per ton	£10 17 6 to £11	£11 to £11 2 6	2/6 dec.
g " " Sheet .. .. per ton	..	£13 10	..
m Manganin Wire No. 28 .. .. per lb.	8/-	8/-	..
g Mercury .. .. per bot.	£8 15	£8 15	..
d Mica (in original cases), small .. per lb.	3d. to 9d.	3d. to 9d.	..
d " " " medium per lb.	1/9 to 2/9	1/9 to 2/9	..
d " " " large .. per lb.	3/8 to 7/8	3/8 to 7/8	..
p Phosphor Bronze, plain castings per lb.	11¼d. to 1/2	11¼d. to 1/2	..
p " rolled bars & rods per lb.	1/- to 1/3	1/- to 1/3	..
p " " strip & sheet per lb.	From 1/2	From 1/2	..
o Platinum .. .. per oz.	£4 1	£4 1	..
p Silicium Bronze Wire .. .. per lb.	10d. to 1/-	10d. to 1/-	..
i Steel, Magnet, acc'd'ng to desc'p'n per ton	From £15	to £40	..
i " " in bars	£58	£58	..
g Tin, block .. .. per ton	£109 10 to £110 10	£110 to £111	10s. inc.
g " foil .. .. per lb.	1/6	1/6	..
n " wire, Nos. 1 to 16 .. .. per lb.	1/5	1/5	..
p White Anti-friction Metals — "White Ant" brand .. .. per ton	£35 to £65	£35 to £65	..
j Yarns, 2/10s Grey Cosson, on sp'le per lb.	7d.	7d.	..
j " 6 tex. Flax .. .. .. per lb.	5½d.	5½d.	..
j " 8 ply 10 lbs. Russian .. per lb.	4 3/4d.	4 3/4d.	..
j " 16 lbs. Russian, single .. per lb.	4½d.	4½d.	..
j " 1s9 lbs. Jute rove .. .. per ton	£10 2 6	£10 2 6	..
k Zinc, Sh's. (Vieille Montagne bnd.) per ton	£21 10	£21 10	..

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd e Messrs. Thos. Bolton & Sons. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

Quotations supplied by { f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakespeare. [Co., Ltd. h Messrs. Edward Till & Co. i Messrs. Bolling & Lowe. j Messrs. Walter H. Hindley & Co.

Quotations supplied by { k Messrs. Morris Ashby, Limited. m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd p The Phosphor Bronze Company, Ltd.

MACHINE TOOLS AT THE GLASGOW EXHIBITION.

(In Special Reference to the Requirements of Dynamo and Motor Manufacturers.)

By FRED. BATHURST, A.M.I.E.E.

(*Concluded from page* 103.)

Side Planing Machines.

Messrs. Smith & Coventry, Limited, of Gresley Ironworks, Salford, Manchester, exhibited an improved side planing machine, which would be found very useful in a jobbing machine shop. This type of machine is already largely used by machine tool makers, because it is so convenient for planing lengthy pieces of work, and the fact that pieces may be worked which have any width of side overhanging. Side planers are decidedly more handy and compact than the ordinary type of planer, and effect a considerable saving of workshop floor space. The makers claim that side planers have many points of superiority over shaping machines, and that they will do a greater quantity of work in a given time. The speed of the cutting tool for all lengths of stroke can be altered without stopping the machine.

Messrs. Smith & Coventry's improved side planing machine (shown in fig. 21) has been modified in several important particulars. For instance, the slides on the bed on which the tool saddle traverses are of box shape and cast rectangularly on the main frame casting. The upward pressure of the cut is thus received on the vertical and lower horizontal surfaces. The tendency of the saddle to lift (under a heavy cut) is thereby done away with, and all the up-play taken up by arranging double wedge strips, which abut against the solid metal of the main frame.

A new belt-shifting motion has been designed, which allows the countershaft, through which the machine is driven, to be fixed at any desired angle either in front of or behind the machine. The feed mechanism is perfectly noiseless and automatic. The tool saddle is driven direct by screw, and has a quick return, and separate pulleys both for forward and backward movements. The main advantage that a side planing machine of the above description possesses is, that work which would require a large and expensive planing machine of the usual type can, if a pit is provided on the front of the side type machine, be bolted to the frame over the pit and a side planer of one-half the proportions of the upright type can be employed.

Messrs. Smith & Coventry make a complete line of these machines which will plane pieces from 18 in. wide and 4 ft. long up to pieces 40 in. wide by 30 ft. long.

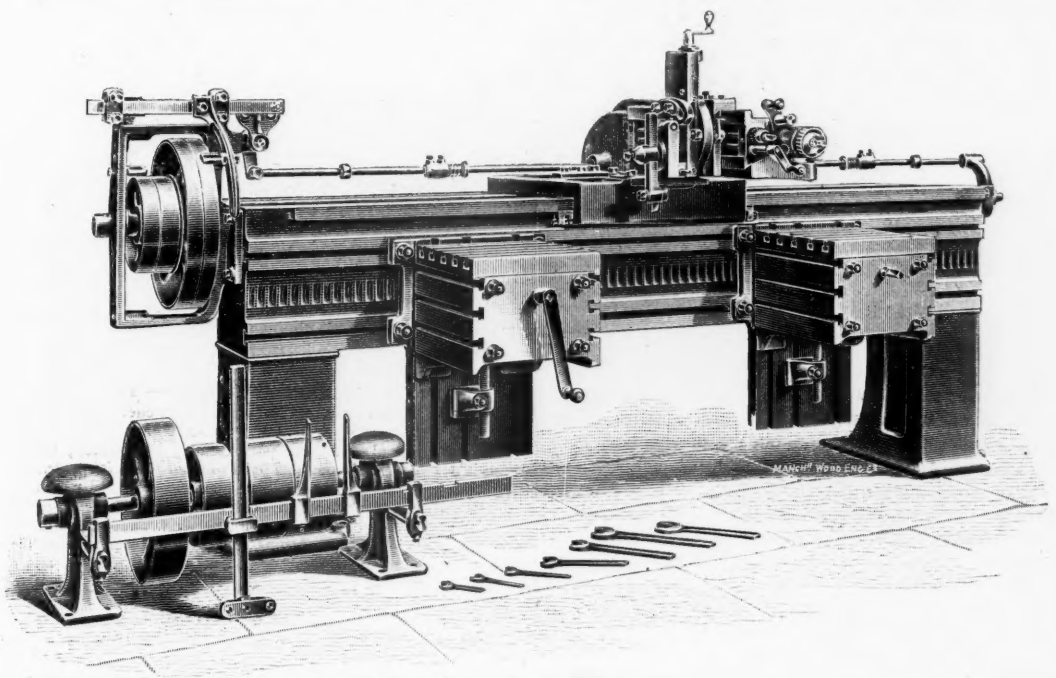


Fig. 21.—Side Planing Machine.

Key-way Cutting Machines.

The same firm exhibited a Knowles patent key-seater machine, of which they are sole licensees and makers. This type of machine (see fig. 22) is economical in price and compact in size, and it is claimed can turn out as much work in the same time as 16 or even 20 slotting machines. The statement is made that 140 key-ways, $2\frac{1}{2}$ in. long by $\frac{5}{8}$ths in. wide by $1\frac{5}{8}$ths in. deep, can be cut in an hour to standard measures, and either taper or parallel as required.

For ordinary tool shops or manufacturers of dynamos and motors such a machine would be invaluable for cutting key-ways in wheels and pulleys. If a pit in the workshop floor is provided at the end of these machines, work up to 6 ft. diameter can be taken. A key-way is cut by one passage of the quill or cutter bar through the box. The sliding rack which draws the quill or cutter traverses the upper surface of the bed-plate of the machine in a slide formed thereon, and is provided with adjustable stops at each end of the stroke for bringing it to a standstill. The pulley to be slotted is arranged on the end and at right angles to the face of the bedplate. The pulley is held in the correct position by a bush being fitted in its bore.

As the work requires no other cramping, a considerable saving of time is effected. The cutting bar is set in motion by the foot treadle underneath the bedplate. The same action also brings the machine to a standstill, when the slot is cut. In order to bring the cutter bar back, a hand lever (shown on the side of the bedplate) is operated.

Messrs. Smith & Coventry supply with the machines a useful table which gives the standard proportions of key-ways relatively to the size of the shaft, both for taper and parallel seatings. The standard taper recommended is $\frac{1}{8}$th in. in 12 in. or 1 in. in 96 in.

As a result of the exhibition of this machine, this firm has largely increased its connection amongst the engineering shops in Glasgow, and machines produced by these makers can already be found in several of the best known English dynamo makers' works.

Conclusion.

Having, in the previous descriptions, endeavoured to select the highest types of machines exhibited for carrying out the

various processes of turning, boring, drilling, and milling, grinding, planing, and gear-cutting, the writer has touched upon the main processes carried out in a machine shop designed to produce electrical motors and other dynamo-electric machinery; but at the risk of somewhat departing from the subject immediately in hand, it should be pointed out that even when the works of the English manufacturer are equipped with the best labour-saving, most accurate, and most efficient types of machine tools, he has still a great disadvantage to overcome.

The writer's experience is that, generally speaking, a greater interest and intelligence is manifested by the American workman over that shown by his English *confrère*, because the American workshop is not so bound down by trade unionism to keep the individual output of the best man in the shop down to the level of the man of mediocre calibre. Under the conditions at present prevailing in England, the workman is being trained, *not* to replace hand labour, because the hand labour that might be displaced (by reason of excess in numbers alone) has a sufficiently powerful voice in the trade union policy to start a howl of dissatisfaction and complaint. In America, *piecework* is more general, and more greatly encouraged by the shop superintendent, who tells his workmen that he is agreeable to let them make twice the wages they could earn on ordinary timework, if they can find out the way to do it upon piecework prices, which he himself fixes, and may alter at any time as opportunity presents. Under these conditions all machines are run at their highest capacity.

Under these conditions, also, the American workman takes the initiative in suggesting mechanical devices to replace his own hand labour. A skilled workman, by being able to bring around him his own selected gang of helpers, not only increases his own weekly earnings, but experiences the difficulties as well as the pleasures of an employer's position, and thus becomes moulded to better recognise the difficulties and limitations imposed upon his own employer.

English manufacturers will further find that the encouragement of piecework, in preference to timework, not only causes the workman to take full advantage of the improved and up-to-date machines provided, but will force them to standardise their manufacturing lines and the types of the machines made, so that the same part can be duplicated as much as possible. In this way it will be found that profit can be made out of an otherwise non-paying business by the reduction which becomes possible on the price of the parts required for the standard line. This again reacts so that the selling price of a particular machine can be reduced below that of competitors, leading to a further increase in the number that can be sold.

The modern manufacturer must have the ability to choose a good standard design, and the pluck to stick to it, and leave to our old-style manufacturers the business of attending to the vagaries of a certain few old customers who want every sort of article from the same manufacturer, the attending to which leads so much to restricting the works' possible output.

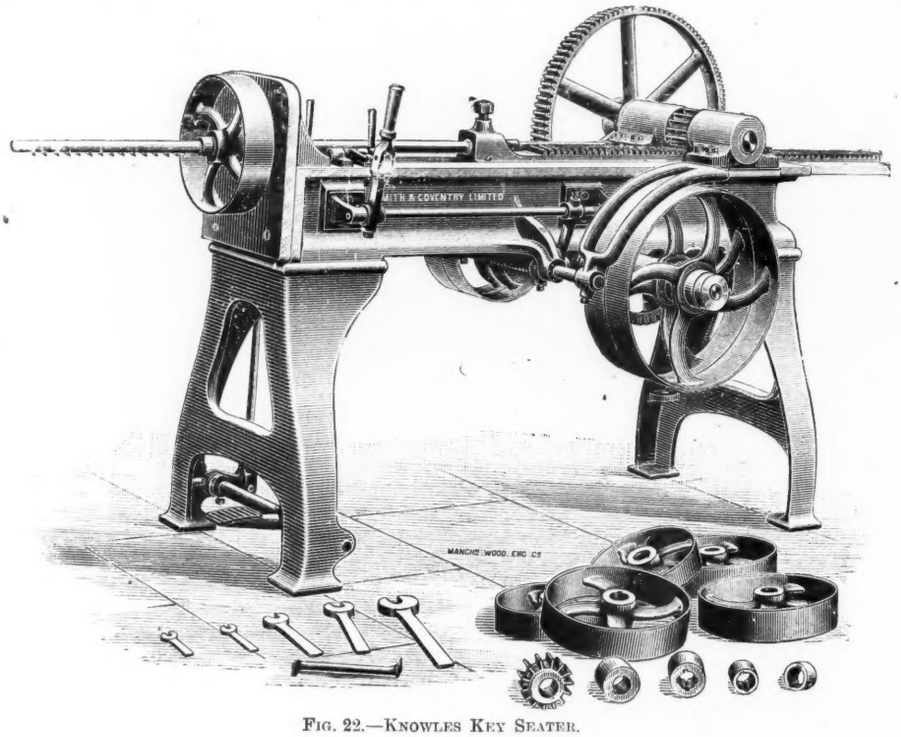


FIG. 22.—KNOWLES KEY SEATER.

The "Chemiker-Zeitung." — The *Chemiker-Zeitung*, one of the most widely known German chemical journals, celebrates this year its 25-year jubilee. Before this journal appeared there were several chemical periodicals in Germany, such as *Liebig's Annalen, Kolbe's Journal of Practical Chemistry, &c.*, but all these were of the high and dry scientific kind. Dr. Krause, the distinguished founder and editor of *Chemiker-Zeitung*, introduced a more popular element into his paper which commanded immediate success. Social questions and ethical questions affecting the members of the chemical profession were taken up and discussed in the journal, which was the means of introducing many practical reforms. Not content with labour involved in the production of his journal, Dr. Krause in 1892 started the publication of a "Year Book of Chemical Industry," and has published several other valuable works of reference for chemists. We wish our contemporary and its able editor a long continuation of their hitherto successful career.

The London County Council Arbitration Clause.— A year ago the Council accepted the tender of Mr. J. Strachan at £470 for the work of excavating the foundations for the lamp standards and the trenching for the mains in connection with the lighting of the Victoria Embankment and Westminster Bridge. That sum included a provision of £20 for such additional works as might subsequently require to be carried out. It was afterwards found necessary to provide four additional lamp standards, and to excavate to a much greater depth than was provided for in the contract with Mr. Strachan, who consequently sent in a claim for payment of £973 in respect of the whole of the work. This claim was, under the provisions of the contract, submitted for the arbitration of Sir Alex. R. Binnie, and he awarded the sum of £675, or £205 more than the contract price. In reporting on this question, the Highways Committee stated they were informed that the sum awarded to the contractor fairly represented the value of the extra works, and they recommended the Council to sanction the payment of the excess to the contractor. This was carried.

Institution of Electrical Engineers (Dublin Section). —At a meeting of the Institution on Thursday evening last week, in the Royal College of Surgeons, Prof. Barrett presiding, Mr. W. Brew read an interesting paper on "Inductive Currents."

STANDARDISATION OF ENGINES AND DYNAMOS.*

(*Concluded from page* 156.)

HOLDING-DOWN BOLTS, KEYS, AND OUTBOARD BEARINGS.

12. We recommend that the holding-down bolts, shaft keys for securing the generator hub to the shaft, and the outboard bearings should be furnished by the engine builders. This is in accord with almost universal practice at the present time.

Our recommendations in these particulars do not cover matters of so great importance as some others; but, if adopted, they will tend to settle certain points about which there has occasionally been dispute and considerable controversy in correspondence.

In the table will be found columns showing sizes of shaft keys which we recommend; also the number and sizes of holding-down bolts.

It will be noticed that we do not give any lengths for keys. We gave this matter very careful consideration, but we found that such differences of opinion existed in respect to proper length, that we believe it best to leave the determination of the length of key for adjustment by engine and generator builders in each individual case.

Sizes of keys have been taken so that standard rolled stock can be employed.

We recommend that the keys be made straight and be used as feathers. They should therefore fit accurately on the edges and not on the top. Proper allowance should be made in cutting the keyway in the armature hub, so that there will be sufficient clearance at the top of the key.

B. Floor Line.—For convenience in operation and for the information of engine and generator builders, we suggest that for units up to 75 KW., inclusive, the floor line should come at the bottom of the sub-base; and for units 100 KW. to 200 KW., inclusive, the floor line should be 1 in. below the rough top of the sub-base.

C. Protecting Commutators from Oil.—In view of the fact that in some cases the distance between bearing and commutator is very small, it is well for engine builders to bear in mind that provision should be made to prevent oil from the bearing getting on the commutator.

D. Some generator builders have asked that the end of the shaft be drilled and tapped to facilitate, if necessary, the removal or placing of the armature on the shaft at the place of erection; we suggest that this be done.

E. In some cases, generator builders require special nuts, bolts, or fixtures for attaching generators to the shaft. Under these conditions we suggest that the generator builders should furnish all attachments to their apparatus that are not already specified in our report.

IN CONCLUSION.

14. In concluding our labours, we desire to express our appreciation of the great interest in our work which has been shown by the engine and generator builders. They have realised that it was for their benefit, and they have helped us very materially by supplying freely the data in their possession and by their intelligent comments and criticisms of our various recommendations. We may say, indeed, that it is this spirit of helpfulness and appreciation that has encouraged us to devote the great amount of time and labour which we have given to the solution of the problem.

We wish also to express our indebtedness to Prof. John E. Sweet, who, as president of the Engine Builders' Association and chairman of their committee on standardisation, has attended all of our meetings and given to us the benefit of his counsel and ripe experience.

We believe that the recommendations we submit herewith will accomplish the object for which the Committee was appointed, and will, if adopted generally by manufacturers, which we have every reason to anticipate, reduce the cost of manufacture, expedite deliveries, and remove many causes of complication and dissatisfaction.

The favourable reception accorded to our preliminary report by the Society leads us to hope that our completed work will be equally satisfactory.

JAMES B. STANWOOD,
FRANK H. BALL,
WILLIAM D. FORBES,
WALTER M. MCFARLAND,
ALBERT L. ROHRER,
Committee on Standardisation of Engines and Dynamos.

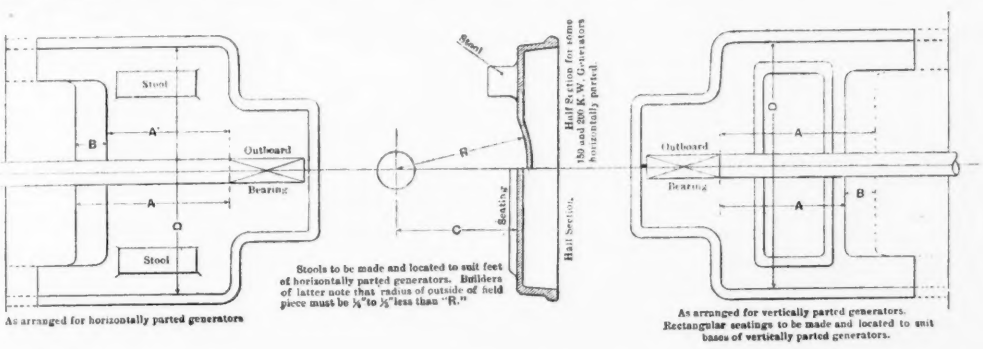
TABLE OF SIZES, SPEEDS, AND STANDARDISED DIMENSIONS OF DIRECT-CONNECTED GENERATING SETS.

(To accompany Diagram.)

Capacity of unit, kilowatts.	Revolutions per minute.	Armature bore.		Diameter of engine shaft at armature fit.		Space occupied on shaft between the limit lines.		B, length of extension pieces, inches.	C, height of axis of shaft above top of base, inches.	R, inches.	D, width of top of sub-base, inches.	Key (A feather).				Holding-down bolts.	
		Centre crank engines, inches.	Side crank engines, inches.	Centre crank engines, inches.	Side crank engines, inches.	Long class A, inches.	Short class A', inches.					Width, inches.	Thickness, inches.	Depth in shaft at edge, inches.	Projection above shaft at edge, inches.	Diameter, inches.	Number.
25	310	4	4½	4 + 1/1000	4½ + 1/1000	30	25	5	23½	Flat.	48	1	¾			1	4
35	300	4	5½	4 + 1/1000	5½ + 1/1000	33	28	5	25	Flat.	54	1	¾			1	4
50	290	4½	6½	4½ + 1/1000	6½ + 2/1000	37	31	6	28	Flat.	60	1¼	¾			1	4
75	275	5½	7½	5½ + 1/1000	7½ + 2/1000	43	37	6	31	Flat.	66	1½	1			1¼	4
100	260	6	8½	6 + 1/1000	8½ + 2/1000	48	42	6	34	Flat.	72	1½	1			1¼	4
150	225	7	10	7 + 2/1000	10 + 2/1000	51	45	6	37⅜		41½	84	1½	1½			1½	4
200	200	8	11	8 + 2/1000	11 + 2/1000	54	48	6	42¾		47½	96	2	1¼			1½	4

NOTE 1.—Five per cent. variation of speed permissible above and below speeds in table.

NOTE 2.—Distance from centre of shaft to top of base of outboard bearing may be less than C (to suit engine builder), though not less than possible outside radius of armature.



SUGGESTIONS.

13. In the course of our investigation our attention has been called to a number of points, which, from their nature, are not exactly in the same category as those on which we have made recommendations, but we consider them of such importance that we desire to offer them as suggestions for consideration by members of the Society, with a view to their adoption if considered sufficiently meritorious.

A. Pressing Armature on Shaft.—Usually the contract definitely provides by whom this is to be done, but our suggestion is that if there is no such provision in the contract, it should be understood that the engine and generator builders shall agree who is to do this work, so as to avoid any dispute when the separate portions of the unit are delivered on the premises.

* Final report of Committee presented at the New York meeting (December, 1901) of the American Society of Mechanical Engineers.

HIGH SPEED STEAM ENGINES.*

By JOHN DAVIDSON.

(*Concluded from page* 117.)

Valves and Gears.—As the author has previously mentioned, the slow revolution type of engine has, in many instances, a valve gear fitted to it, which is of most fearful and wonderful design. Some are fitted with simple gears, which give little trouble, and are economical, but it seems to have been the aim of many builders to put as many links and joints as possible in the valve gear of the engines, and the author asks here—What is gained by all this complication? In many cases it is done simply to be able to govern the engine by automatic expansion, and in others so that the cut off may be altered as desired by hand, and in many other cases to enable the designer to get a better distribution of steam, or a nearer approach to a theoretically perfect diagram than can be obtained by simple valve gear. Quick revolution engine builders, it must be pointed out, have had to drop this complication of gears because they could not do anything else. It would not fix at 500 revolutions per minute. One or two builders of quick revolution engines, it must be admitted, have managed to design, construct, and get to work gears with as many cams, links, and such like fittings, as is possibly convenient, to try and obtain some result slightly better than other people if possible. By fitting this paraphernalia they obtain, in one case, very small clearances in the cylinder; in another, automatic expansion conveniently, and such like. But does it pay to fit this tackle to an engine? Willans, Belliss, and Browett-Lindley do not do it, and they get equal results, and, in many cases, better, than any other engines on the market fitted with the most complicated types of gears imaginable. This extra complication requires keeping in repair, and this means a big bill at the year end. It often entails much more labour in the way of attendance in the engine room, which, when taken into consideration at the year's end, amounts also to a very large item.

Slow revolution engine builders, and others who advocate this type of engine, will naturally say that the author has got the modern high speed craze. Perhaps he has. These are high speed times, and engines are not built for ornaments or playthings as a rule. One does not give £1 to have done what it is possible to get done for 1s. in another manner, equally efficient. The points the author wishes to question is, if Willans, Belliss, and Browett-Lindley can get results with their engines—results equal to any engine fitted with complicated mechanisms, why perpetuate these complicated designs? Who would think of putting a beam engine to drive a dynamo? The old beam engines did good work, and were suited to their duties perhaps better than any other type of engine then in existence, and perhaps for many years afterwards, but that is no reason why we should use them now. Corliss and other slow revolution engines, drive mills and machines of all sorts, and do it well in many instances, but it is not essential that we should copy them.

Then, again, some imagine that simple (not complicated) quick revolution engines are only suitable for small powers, but that, of course, is a mistaken idea. How is it that the largest engines in the world, on our steamships, are of the simplest design that could be wished for, and are undoubtedly the most economical of engines? Now that electric traction and centralisation of electrical power and lighting stations has necessitated the adoption of large units, at the present time reaching to 12,000 I.H.P., as a maximum, the author thinks it is a question worthy the study of all central station engineers, and of those who are responsible for the design and equipment of power stations, to consider whether they will have an engine with many valves and endless gears, or whether they will have an engine with simple valves and gears which will give equal economy—for this they can obtain a guarantee—also less attendance required, less liability to breakdowns, less repairs, less cost, and above all, the author thinks, is a point worth every human being's consideration—less to worry about.

Governing.—The problem of how to govern an engine of any type satisfactorily is one which has received more attention than any other point necessary for the efficient running of engines. Quick revolution engines have one advantage over the slow revolution engines in this respect, owing to the fact that when the governor has shut off the steam to the engine, whether by throttling or automatic expansion, the quantity of steam then left in the engine is a very small amount. For instance, if an engine of, say, 500 H.P., be running at 75 revolutions per minute, and doing full load, and the whole load be suddenly thrown off the engine, we may take it that as a minimum there will be at least one cylinder full of steam already in the engine capable of doing work, and ready to accelerate all the moving parts before the governor has really control of the engine. If an engine of the same power be running at 450 revolutions per minute under similar circumstances, we should have only one-sixth the quantity of steam in the engine which could not be affected by the governor. Thus it will be seen that it is possible to obtain finer governing under sudden variations of load with a quick-revolution engine than with one of the slow-revolution type, assuming, of course, that the governing mechanisms are of equal efficiency for both types. This, at least, is the only point in connection with governing in which the quick-revolution engine gains any advantage over the slow-revolution type.

The majority of quick-revolution engines at the present time are governed by means of the throttle valve, and not by automatic expansion, as are nearly all of the latest type of slow-revolution engines. The true reason why this has come about is that it has been found from actual tests that the advantage of automatic expansion over throttle governing is infinitesimal at (and about) full load. When the variations of load are not very excessive, or when an engine works mostly from about five-eighths to full load, for economy's sake, automatic expansion is the preferable type of governing to adopt; but when an engine is liable to work for considerable periods at light loads, say, from quarter to half, the throttle governor is the most suitable. With an engine fitted with Corliss gear, it becomes a very simple matter to vary the cut-off in the cylinder, as very little power is required in the governor to alter the point at which the gear must trip; but it is a very different matter to make a satisfactory governor for a quick-revolution engine so that the cut-off may be varied automatically, especially when this has to be done by the governor altering the position of the eccentric driving the valve, as it necessitates a very powerful governor. This difficulty has no doubt caused most engineers to adopt the throttle-valve type of governor for quick-revolution engines, it being a simple matter to produce a centrifugal governor of sufficient power to move a throttle valve, and as the advantage gained by the automatic expansion is really so small, many have given up the attempt to produce a suitable governor of this type, rather being satisfied with something that is easy to produce, and which they know from experience will not give trouble in practice.

It would be impossible here to deal with the various types of governors adopted for governing either by a throttle valve or otherwise, but the author firmly believes that results equally good, so far as speed regulation is concerned, can be attained with either system of governing, all depending upon the design of the governor mechanism. It will thus be seen that the type of governor to be adopted for any engine depends upon the class of work the engine is to be used for. If for a practically continuous steady load, the throttle valve governor will do all that could be wished for; but if the engine is liable to have to work for short periods on excessive loads, and also liable to work at loads varying from half to full load—such as for electric traction purposes—the automatic governor is no doubt the most suitable one to adopt. A combination of variable expansion and throttle governor is no doubt the ideal thing to arrange if an engine has to be made to work most efficiently at all loads. There are other ways by which excessive overloads on an engine can be dealt with, such as fitting a supplementary throttle valve, which will supply steam direct to the L.P. cylinder, say, of a compound engine, but this necessitates a complication which can be avoided if automatic variable expansion is adopted.

A slow revolution engine with equal number of cranks requires heavier fly-wheels to keep the angular variation per revolution within the same limits as that of a quick revolution engine of the same power. This extra fly-wheel, therefore, helps the governor when any sudden change of load takes place, so it is truly difficult to find any very great difference between the two classes on this score; but it is worth notice here that heavy fly-wheels are not revolved in their bearings without any power being exerted; therefore the mechanical efficiency of an engine with heavy wheels must be less than one with light wheels, other conditions being the same.

It is impossible to deal with the governing problem here, and as it is one which is common to all engines, it is not necessary to do so.

In practice it is possible to govern both types of engines to within the same percentage of variation when efficient governors are used, so little more can be said on this point, except that with quick revolution engines it is possible to put the governor direct on to the crankshaft and thus dispense with all gearing. This does away with a very frequent cause of trouble, and is another feature in favour of high speed.

Within the time at his disposal the author has found it impossible to say something respecting all the interesting features in connection with the development of quick revolution engines, as many require a paper to themselves to do them justice; for instance, balancing of engines, vibration, &c., all of which have received very careful study by the several engine builders in bringing their standard engines to their present state of perfection.

High speed has been the cause of simplification in almost every detail of engines. In the best of engines you find the minimum number of parts, all fancy rod ends dispensed with—wedge adjustments, gib, strap, and other appliances having been replaced by simple marine type ends, a couple of brasses held together by a couple of bolts, and main bearings consisting of plain bushes in halves held down by cap and bolts, &c. The development in this direction may appear surprising, but, contrary to expectations, the wear on all parts is so little, and adjustments in well-designed engines are so rarely required, that the plain bushes, held together by cap and bolts, leave nothing to be desired; and as it is absolutely necessary that all bolts, screws, &c., of the moving parts should be positively locked, the fewer there are of them the better.

Quick-revolution engines are now built of all types: single cylinder, compound two-crank and three-crank, triple expansion two and three-crank, and no doubt before long the four-crank triple expansion engine will be a common type, as larger and larger powers are being called for daily.

Ten years ago engines for driving generators of 500 H.P. were considered a large size, but now 2,000 to 3,000 H.P. plants are common, and the leading quick-revolution engine builders have standard patterns up to 3,000 H.P.

[The author gave illustrations and descriptions of two well-known types of engines, viz., Willans & Robinson and Browett, Lindley & Co. The descriptions are abstracted on the next page.]

* Paper read before the Liverpool Engineering Society on December 4th, 1901.

* Final report of Committee presented at the New York meeting (December, 1901) of the American Society of Mechanical Engineers.

WILLIAM D. FORBES,
WALTER M. MCFARLAND,
ALBERT L. ROHRER,
Committee on Standardisation of Engines and Dynamos.

The Willans central valve engine is a vertical single-acting engine, whose working stroke is the down-stroke, the piston or pistons having equal pressures on both sides during the up or return stroke. The valves (of the piston type) work inside the hollow piston rods (or "trunks"), and give an excellent distribution of steam and unequalled drainage for water, as the exhaust ports are so placed, that the rush of steam tends to carry out the water with it, not only at the moment of opening the port, but continuously through the *whole* of the up-stroke, this action being assisted by the dished form of the patent pistons employed. The brasses are arranged to be constantly in compression; that is to say, the piston-rod is kept pressing in the same direction (downwards) against the connecting rod, the latter against the crankpin, and the crank against the main bearings, not only throughout the working stroke, but through the return-stroke as well.

The steam enters the H.P. cylinder until cut off by the passage of the ports through the gland. The point in the stroke at which cut-off takes place is governed by the height above the cylinder top to which the gland rings are raised by a distance piece placed below them.

The two-crank compound engines of Messrs. Browett, Lindley & Co., Ltd., are built in standard sizes for any power between 50 I.H.P. and 2,000 I.H.P. The steam distribution is effected by means of two piston valves, one for the high pressure and one for the low pressure cylinder. Messrs. Browett, Lindley & Co. have found that they can build a more economical engine by fitting separate valves to each cylinder, and their engines are so designed that they can be arranged to be governed either by throttle or automatic expansion, as may be desired, every detail in the engine remaining the same, the governor only being changed. The valves are actuated by means of eccentrics in the usual way, and when the automatic expansion governor is fitted, the position of the high pressure eccentric is controlled by the governor. All the working parts are enclosed and lubricated by oil under pressure.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"LIGHTNING CONDUCTOR" writes:—"A client of mine wants to have electric light supplied from a friend whose premises adjoin his.

"1. Is there any regulation to prevent the friend supplying him?

"2. If there is, could they be joint owners in the plant, each to take his light and share expenses?

"His grievance is that the supply company charge him the same for business purposes as they do private consumers. They have no rebate system, and he burns his maximum number of about 100 lights continuously for an average of five hours per day all the year round."

*** With regard to the first question, there is nothing in any provisional order or special Act which has been before us prohibiting an arrangement of the nature suggested by our correspondent. It has been repeatedly pointed out in this column that the Electric Lighting Acts, whether private or public, are permissive only, and do not entitle "undertakers" to interfere with anyone who chooses to generate electricity on his own premises and sell it to his neighbour.

As to the second question, our correspondent's client and his neighbour can enter into whatever agreement they wish as to sharing the expense of an installation.

"C. H. B." writes:—"Thanking you for your answer to my query of last week, I shall also be glad if you will give the following information in next week's ELECTRICAL REVIEW, viz., Is there any specified height which overhead wires are to be kept above the roadway in any Government regulations, &c.?"

*** There is no regulation as to the height of wires above streets in towns outside the Metropolis. We believe that the London Overhead Wires Act contains some regulations on the point, but it is obvious that the provisions of that statute do not affect our correspondent. In a case decided some years ago by the late Master of the Rolls, wires suspended at a height of 40 ft. above the roadway, were held to be no nuisance.

"NICKEL" writes:—"I am a small wiring contractor, and I received a contract to wire some premises on the circuit of an electric supply company.

"Previous to starting the wiring, I, or rather my client through me, made application for the supply of energy. This was on December 18th or 19th, 1901. On the 24th of the same month my client received a further agreement or application to sign, with a request that he should furnish the authorities with a sum of £3 as a deposit. This he immediately complied with, and a receipt for same was sent in due course by the authorities.

"Does this not seem as if my client was accepted as a consumer? I thought it did (as it is the first work I have done on this supply circuit), so I at once commenced operations, and wired the premises. After completion, I waited three or four days to see if the authorities would connect in the meantime, but they did not, so I wrote them, and in reply, I received the following letter:—'With reference to your application for a supply of current to . . . . Road, and your post card of the 2nd inst., I beg to inform you that we have no mains nearer than about 117 yards from the premises in question. It will therefore be impossible for us to make this connection, unless you are prepared to pay for laying mains in this street, for everything over 60 ft., which is the limit of distance we can carry the supply free.'—Yours faithfully, &c.

"I wish to know:—(*a*) whether my client ought to have been notified in the first instance of the inability of the company to supply? (*b*) whether there is any remedy open to me for the inconvenience and expense to which I have been put?"

*** As to the first question put by our correspondent, we are of opinion that, since the premises in question are not situate within 50 yards of the distributing main, the undertakers are not bound to supply the occupier. This seems to be quite clear from Clause 27 of the Schedule to the Electric Lighting Clauses Act, 1899. It was, therefore, open to the company to have refused to comply with the occupier's request.

As to the "agreement or application" of December 24th, referred to in the contractor's letter, presumably this was merely a form of application for supply (and this presumption is supported by the company's letter). In that case, we fail to see how the company can be held to have gone so far as to accept the occupier as a consumer. They must of course return the deposit. This being the position of the parties, it is hard to see how the company should have straightway notified the occupier that any communication between their main and his premises would have to be established at the expense of the occupier, save for the first 60 ft. from the main, for which distance they are bound under Clause 27 *(ubi supra)* to communicate free.

As to the second question, it appears to us that the contractor has acted on a too hasty assumption, and at his own risk; and that there is no remedy against the company for the expense to which he has been put.

DINNER OF THE INSTITUTION OF JUNIOR ENGINEERS.

THE 17th annual dinner of this Institution was held on Saturday last, at the Hotel Cecil, the president, Sir John Jackson, presiding. Among the guests were Admiral Sir E. R. Fremantle, G.C.B.; Lieut.-Gen. Sir W. F. Butler, K.C.B.; the Hon. Thomas E. Fuller, Agent-General for Cape Colony; Sir A. R. Binnie; Sir John Murray, K.C.B.; Mr. C. Hawksley, President of the Institution of Civil Engineers, and others.

After the usual interval, the President proposed the Loyal toasts and the three services. In reply Admiral Fremantle commended the proposed amalgamation of the executive and engineering branches of the service, and vigorously advocated a stronger navy, which, he said, is both a link with the colonies and an insurance for our commerce.

General Butler, replying for the regular and volunteer forces, said the army needed no one to apologise for it and no one to praise it; its most eloquent speech was silence. With the Duke of Wellington, it relies on its past record and "doesn't care a tuppenny dam for whatever may be said against it."

Sir John Murray, proposing "Our Dominions Across the Seas," regarded the colonials as "dynamic," the home folks as "static," advocated a ministry of junior engineers, and relapsed into poetry.

The Hon. Thomas E. Fuller, in his reply, carried the meeting with him; his text was "Freedom," which he said was the great bond which unites the Empire. The Cape had always given "fair play and freedom" to all races, and following the same principles he was most hopeful as to a speedy settlement after the war.

Sir A. R. Binnie was called upon to propose "Improvements in Passenger Transit," and gravely told us that the horse was doomed; that the overhead trolley would not be allowed in London; that "tubes" had their advantages; that the restrictions imposed upon automobiles should be removed; and that a better means of storing electricity was badly needed; all of which has been common knowledge for months—nay, years.

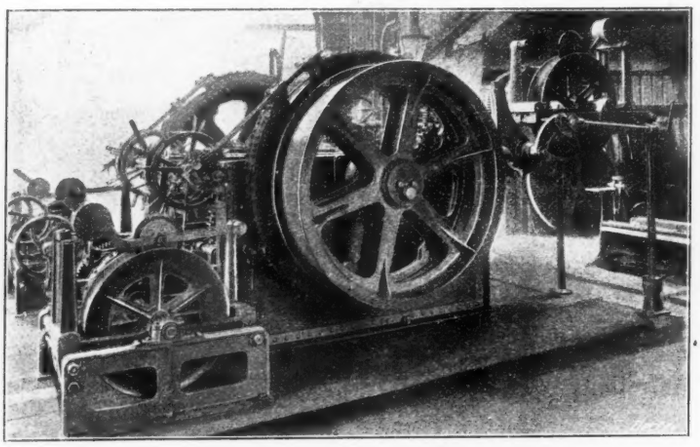
Mr. F. S. Pilling, in a neat reply, complained of the obstructions placed by municipalities in the way of comprehensive tramway schemes, and gave, we think, rather too much support to the over-done statement that America is getting the cream of the work. *Was*, we admit, but not *is*.

Mr. Hawksley toasted the I.J.E. in complimentary terms, and in reply, Mr. Percival Marshall acknowledged the debt of the Institution to the Institution of Civil Engineers, recounted recent successes of Junior Engineers (one of whom was admitted full member of the Civil Engineers without passing through the intermediate stages), and described the endeavours which are being made to promote greater sociability between the members.

During the evening Mr. Sidney Anning, Mr. Kenneth Gray, and Mr. Geo. Bullock entertained the company with songs and sketches, and Mr. T. E. Gatehouse gave violin solos. The function wound up as usual with "Auld Lang Syne."

A NEW TELEGRAPH STEAMER, SS. "VIKING."

It is now nearly 30 years since Messrs. Mitchell & Walker, of Newcastle, were asked by Hooper's Telegraph Works Co., Ltd., to build the first steamer for laying and repairing telegraph cables. The result was a steamer of 4,935 tons gross tonnage, we believe the largest cargo boat, with the exception of the Great Eastern Steamship, built up to that date, though now surpassed by others built for the same purpose, notably the *Anglia*, owned by the Telegraph Construction Company, Limited.



Double Combined Picking-up and Paying-out Machine.

The main features in the ss. *Hooper* were the three circular cable tanks, 50 ft. in diameter and 30 ft. deep, which were large enough to carry a cable of sufficient length to bridge the Atlantic from Ireland to Nova Scotia. A two-bladed propeller driven by compound engines furnished the motive power, and a special pair of engines were erected to drive, by means of a wire rope, a propeller in the stern of the vessel placed in a line with the keel in order to make the manœuvring of the ship possible without working the main engines and helm; but the wire rope was not a success, and in the ss. *Faraday*, built within a few months of ss. *Hooper*, the control was effected by means of twin screws, now universally adopted for the larger steamships. The latest telegraph cable laying and repairing steamer ss. *Viking*, built to the order of the Amazon Telegraph Company, arrived in the Thames some two weeks ago, and has been taking cable from Messrs. Hooper's Works in the Millwall Docks. Though the tonnage is small, the steamer has been fitted with three cable tanks, two being 30 ft. in diameter, and being intended for cable work on the River Amazon, has been designed to carry a heavy load on a light draught, and every precaution has been taken to meet the unpleasantness of the tropical climate.

The cable machinery has been manufactured by Messrs. Johnson and Phillips, of London and Old Charlton, under contract with the shipbuilders, Messrs. Sir W. G. Armstrong, Whitworth & Co., Limited, of Newcastle.

It comprises a double combined picking-up and paying-out machine with bow and stern gears, dynamometers, leads, bell-mouths, crinolines, and hauling gears, all of which embody the makers' up-to-date improvements for the rapid and efficient working of the cable. The double combined machine, which we illustrate, is made in accordance with Messrs. Johnson and Phillips's latest patents, and is designed to pick up under a strain of 20 tons at the rate of half a knot, another speed of 2 knots being provided at which the machine is capable of picking up under a strain of 5 tons. It comprises two absolutely complete machines with two double-cylinder engines, the two machines being built on three frames, and so arranged, with all actuating apparatus brought to the after end of the machine, that the machines can be controlled entirely from one position, and under general conditions of working, by one man. The machine embodies many special features:—

1. Two separate machines, which may be worked independently of one another or in combination.

2. Two engines, so arranged that either or both may work either or both machines, thus covering all possible combinations, and allowing the port engine to work the starboard machine or the starboard engine to work the port machine, which would be advantageous in case of a breakdown of one or the other. Usually one engine would be sufficient for all ordinary work; there is thus the advantage of running one small engine at a high efficiency instead of one larger engine at low efficiency.

3. All actuating apparatus for steam stop valves, drain cocks, reversing gears, main brakes, speed gear wheels, wheel-shifting gear, clutches, holding-back gear brakes, free-wheel gear, traversing gears, &c., taken to the after end of the machine, so that the machine can be controlled completely and absolutely from one position.

4. "Hauling-off" and "holding-back" gears are provided both fore and aft of the machines, enabling the working of the cable direct from tanks both forward and aft of the gear without having any awkward leads or turns for the cable.

5. These gears are provided with free-wheel driving arrangements, allowing the sheaves to run free, controlled by the brake (when paying out), but automatically driven immediately the machine is reversed for hauling back.

6. A friction driving arrangement is also provided to obviate the risk of breaking the gear teeth and of tearing the serving off large cables due to the gear trying to haul the cable off the drum at a faster speed than the drum is delivering it.

7. Screw-traversing gear is provided for traversing the "holding-back" sheave with its jockey gear and cable guide across the face of the drum for "inside" or "outside" lead while the machine is running.

8. The holding-back gears are provided with screw brakes with adjusting nuts to prevent the braking power being increased inadvertently after once being released. The brake straps are suspended so as to release equally around the brake wheel.

9. When not required for "hauling-off" purposes, the driving wheels of these gears may be completely disconnected from the main machine by sliding an intermediate wheel out of gear, thus avoiding any rattle.

10. The drums are arranged to run loose on the shaft, thus enabling the shaft to be made a fixture and attached permanently to the frames, forming a very rigid structure.

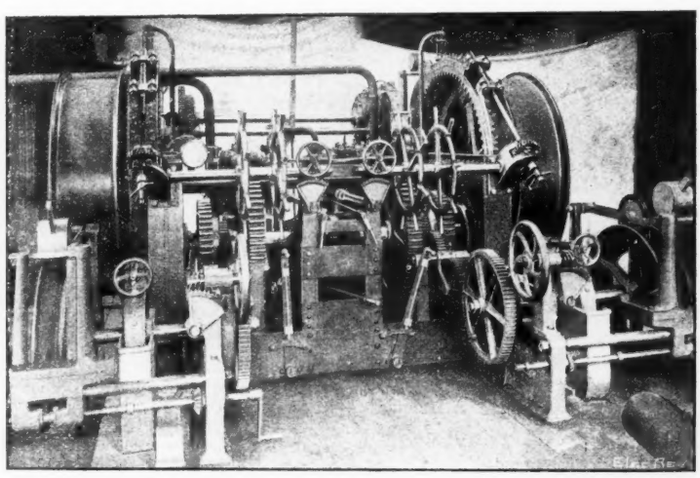
11. The brake rings and the large gear wheels are combined with the drum, thus relieving the shaft of all torsion.

12. Another advantage of the drum running loose on the shaft, is that when paying out is being carried on without the engine, the drum is the only part of the machine (beyond the "holding-back" gear) which is running.

13. A fixed lubricator is provided on the end of the shaft so that the drum bush can be lubricated while it is running.

14. The main brakes are actuated by hand wheels through the medium of worm gearing, thus allowing of exceedingly fine adjustment for paying-out, with enormous power for holding when picking-up, and that with extreme ease of manipulation.

15. The brake screw is provided with a safety adjustment lock which (after being set for any desired strain) prevents the strain from being increased inadvertently after the brake has been released.



View from After End of Machine.

16. The brake strap is suspended by spring attachments ensuring the strap releasing equally all round the drum and thus making the action of the brake more delicate.

17. A water-service pipe, with connection to a pump, is attached to the back of the brake strap with nozzles at intervals between the brake blocks, thus directing water immediately on to the face of the brake drum all round its periphery.

18. A clutch is provided on the second motion shaft enabling the power of the two brakes to be brought to bear on either drum, thus securing very ample brake power for any emergency.

19. All main gearing is of steel, and all wheels are arranged so that when not required for driving they can be moved out of gear so as to avoid undue rattle.

20. The teeth of all the wheels are specially shaped so that they may be put into gear or be taken out of gear while the machine is working at moderate speed.

21. A clutch is provided on the first motion shafts to couple both together when both engines are required on one gear, or when a cross drive from port to starboard, or *vice versâ*, is required. A clutch is provided on the second motion shafts to couple the drums or brakes together.

22. Special clutches are provided to take the bevel wheels out of gear with the engine pinions readily, and yet to take the thrust of the bevel gear efficiently when in gear.

23. There are inside and outside fleeting knives to each drum actuated by worm gear and hand wheels. The drums are 5 ft. 8½ in. diameter × 17 in. wide between the flanges. The space occupied by the machine is 16 ft. × 13 ft., and the total weight is 25 tons.

The bow gear has three sheaves 4 ft. 3 in. in diameter, each complete with cast-iron whiskers, and carried in bearing blocks on steel girders built into the ship; arrangements are made so that each sheave can be lubricated while it is running. The stern gear has one sheave 3 ft. 2 in. in diameter fitted similarly to the bow gear.

The dynamometers are of Johnson & Phillips's improved type with a special provision of internal spring, enabling them to register very low strains as well as the higher strains without the need of adding or removing weights which is usually experienced.

Sheave leads are provided as span wheels at each side of the dynamometers, but the general leads from the tanks to the cable machine consist of opening bellmouths carried on cast-iron columns making a very neat job, effectually confining the cable, and yet allowing it to be released readily when desired.

The tanks are provided with the necessary crinolines, and with opening bellmouths (carried on steel girders) for leading the cable to and from the cable machine.

A hauling gear is provided for turning-over purposes, arranged to work by hand, or to be driven by rope messengers from the ship's winches.

Our illustrations are two views of the double combined picking-up and paying-out machine as taken at Messrs. Johnson and Phillips's works, directly after the very satisfactory trial made under steam in the presence of Mr. G. Keith, of the Amazon Telegraph Company, Limited, Mr. George Thompson, their consulting engineer, and Mr. A. Gulston, representing Messrs. Sir W. G. Armstrong, Whitworth & Co., Limited.

The steamer will take 50 knots of 5-ton cable and some heavy shore end cable and will proceed to Para to replace the old repairing steamer of the same name. Messrs John Thompson & Son have superintended the building and fitting out of the ss. *Viking* for the Amazon Telegraph Company, Limited.

REVIEWS.

Protection: the Views of a Manufacturer. By G. BYNG. London: Eyre & Spottiswoode. 1901.

Mr. Byng has made in this work a determined attack on the strongholds of Free Trade. He is a manufacturer, and most manufacturers are unable to bear with equanimity the importation of commodities which they would like to manufacture themselves. He therefore argues as others argued aforetime, that the prosperity of the nation depends upon himself and those with similar interests, and he proposes not to rest content with writing a book, but to open an office for the purpose of obtaining and disseminating information wherewith to continue an agitation which he has so much at heart. His book contains ample evidence that he has investigated the subject from the earliest times. The examples of Simon de Montfort, who, in the thirteenth century, forbade any cloth to be worn that was not of English make; and of Richard II., who ordained that the export of British goods should be restricted to British vessels, are quoted, as we gather, for commendation. The fact that Edward IV. placed restrictions on the importation of many articles of foreign manufacture in response to the representations made to him that considerable injury was being done to English trade "by the importation of foreign goods of better quality and workmanship," is apparently suggested as a precedent which Edward VII. might appropriately follow.

But "the utter callousness of the present-day Free Trader" is a source of sadness to the author of "Protection." He thinks they might be compared to the old Spanish inquisitors, who cried: "For the glory of the church I have killed another heretic." And this he paraphrases by the mouth of the free trader: "For the glory of the free trade principle I have killed another British industry." The quotation suggests to the reviewer that Mr. Byng's studies in free trade are akin to the agnostic's study of the Bible—not for enlightenment, but to support a pre-conceived hypothesis. And we may as well at once warn any ardent free traders that it will be perfectly useless for them to indulge in any argument with Mr. Byng. They are condemned beforehand. Such phrases as the following are not infrequent:—"Does this really involve a hardship on the home consumer? I say No. To maintain that it does is mere sophistry" (p. 12). Or again: "The whole of the argument advanced by a free trader is a poor and weak apology for reasoning" (p. 13).

Though there are not wanting indications that the early free traders were, in the author's opinion, misguided individuals, the first chapter recognises that from 1846 to 1875, free trade was productive of unalloyed good. From 1876 to 1900 it was a case of six of one and half a dozen of the other, whilst from 1901 to 1912, free trade is going to be absolutely detrimental to the interests of the nation, without any qualifying advantage whatever. And it is this record of the past, and prophecy for the future, which Mr. Byng undertakes to demonstrate in remaining chapters, although we have not yet grasped the governing causes for the arbitrary selection of the dates which have been mentioned for the see-saw of advantage and disadvantage. However, one of the main points is the demolition of the Free Trade theory that in a Free Trade country manufactured articles can be produced cheaper than in a protected country. "This law is untrue," says the author, and not only so, but the contrary is the fact; "a manufacturer in a protected country can manufacture at a cheaper rate than a manufacturer in a Free Trade country."

The proof is a consideration of the cost of manufacture of a definite article in quantity whereby the cost is reduced in proportion to the quantity manufactured. The principle is unquestionably sound up to a point, but the author seems to confound the large output of one manufacturer with the output of a whole country. The distinction needs to be more carefully drawn. In protected countries the protection is against ourselves. Internal competition may, and does, exist. Where it does exist the commodity must be in very considerable demand before any individual foreign manufacturer can have a predominance over a manufacturer in another country. Where it does not exist the manufacture must be protected by patent laws or by a combination of manufacturers. In all countries patent laws have a time limit, and the efficiency of "combines" as mediums of economical manufacture has yet to be determined. The element of large output is in its favour, but the process of combination in manufactures is comparatively new, and time may develop features of weakness only yet dimly discerned. Mr. Byng feels, like so many others in their individual experience, the disadvantage which results from the free ingress of goods of foreign manufacture, representing as they allege the surplus produce of the foreign manufacturers' home market. He calls England "the dumping ground of the world." Now, "dumping ground" we understand to be equivalent to those "desirable building sites," or other plots, upon which the owner places a notice that "rubbish may be shot here." Mr. Byng doubtless thinks that the foreign rubbish being shot in this particular spot is highly objectionable, but the owner of the ground, anxious to level up his plot, considers that he has acquired a benefit, and we are afraid the much-maligned free trader would argue that if the English consumer obtains for nothing, or next to nothing, something for which the foreign consumer has to pay heavily, the English consumer is better off in the application of the article of consumption or use than the foreign consumer. If it should happen that the English manufacturer of the identical article is momentarily incon-

working, by one man. The machine embodies many special features:—

which (after being set for any desired strain) prevents the strain from being increased inadvertently after the brake has been released.

venienced, he will, unquestionably, in time participate in the benefits of the subsequent distribution of the acquired-for-nothing, or next-to-nothing, wealth.

But protection of manufactures by import duties is not the only change advocated by the author of "Protection." Our patent laws, he thinks, should be amended, so as to encourage manufactures instead of, as now, to give protection without any obligation to manufacture in our home market. As examples, Mr. Byng instances the telephone. The patents on the receiver and transmitter, he says, were purchased by a company. "Instruments were made in considerable numbers in London, Woolwich, Manchester, Halifax, Darlington, &c.," and how were the manufacturers treated? "The gratitude of the country for the starting of a new trade was shown by the passing of lawyers' letters, the issue of writs, and the serving of injunctions . . . . and respectable men, such as Mr. Dale, an electrician, trading in Ludgate Hill, were actually put in prison for having manufactured a few telephones."

When it is remembered that the instruments referred to were manufactured in defiance of patents granted by the State, it is difficult to understand how anyone can refer to "the gratitude of the country" for infringing the country's own laws. Again, it is unfortunately true that "the manufacture of a few telephones" led to the imprisonment of one or more infringers, but legal students do not need reminding that imprisonment for infringement of patent, like imprisonment for debt, is only possible when the Courts of the Country are treated with contempt. Pursuance in a policy of manufacture in defiance of the Courts' decision is contempt of Court, and any such case very properly calls for punishment. If the punishment is one of imprisonment, it is because the Court is of opinion that it is a flagrant case. Again, Mr. Byng says the company owning the patents "made a show of manufacturing telephones by means of a subsidiary organisation in Farringdon Road, London, but, for the reasons which I have already explained, the attempt was a failure." He further complains that his repeated applications to Mr. Morgan, the then manager of the United Telephone Company, for a license to manufacture telephones were refused, though he offered to pay a heavy royalty. Here, again, some explanation is required. Mr. Morgan or the United Telephone Company had no power to confer a license to manufacture. They had already disposed of the manufacturing rights to the Consolidated Company, which was not a "subsidiary," but an independent, organisation, which had given valuable consideration for the manufacturing rights transferred to it. The instance selected by Mr. Byng seems, therefore, somewhat unfortunate, since the patents were exploited by manufacture.

Nevertheless, it is not to be assumed that we consider Mr. Byng's suggestion for compulsory manufacture an unreasonable one to put forward for argument. But it requires arguing from an entirely different standpoint. The difference between English and Continental patent laws is, that whilst England protects brains without restriction, Continental countries only protect brains when the brains give employment to hands within their own borders. Which is the more profitable in the long run would need careful investigation, and especial care to avoid conclusions from apparently strong cases limited in number. Meantime we must consider that the protection of brains, if occasionally disadvantageous, is, under any circumstances, the highest kind of policy, and, like honesty, is usually found to be the best policy.

We may return to the general question of manufacture where no patent protection exists. As a manufacturer, Mr. Byng's own experience is of value. He relates a case of a manufacture lost to this country and found by protectionist Germany. In 1895 he was asked to take up the manufacture of a new kind of tube. It was invented in America. There were no "valid patents" to restrict its manufacture. An American offered to provide the machinery specially designed for manufacturing the tubing. The local manufacturer was to build a factory and the combined investors were to share he profits. A similar offer was made to a Berlin firm. Mr. Byng declined, and the Berlin firm accepted. Mr. Byng declined because he realised that the English manufacture would be subject to the competition of both Germany and America; and, as a result, the new industry went to Germany and was lost to England, which, nevertheless, buys large quantities from Berlin. We do not wish to question Mr. Byng's commercial acumen. His decision to decline the offer was possibly quite right, but the inference drawn from it seems to be too wide. There are, presumably, other kinds of tubing than the one referred to. If the Berlin manufacturer is selling at a lower price than Mr. Byng would have done, the consumer is surely obtaining some benefit, and local manufacturers of other kinds of tubing are put upon their mettle to produce a cheaper, and, perhaps, superior article. Our view in this may be entirely wrong, but we are not aware that the market for electrical tubing is monopolised by German manufacturers, and we believe that the tubing of English manufacture does not need a protective duty for its support.

Whilst we have selected some of Mr. Byng's theories for comment, we cannot pursue them all, and whilst in those selected for comment, our conclusions are inclined to be adverse to his, we do not wish it to be assumed that there are no portions of his book with which we agree. The appearance of this book is a sign of the times. We regard it as inevitable that the minds of manufacturers under the recent writings of the daily Press should turn to protection as affording a happy issue from all their troubles. We may expect that other manufacturers will follow Mr. Byng's lead. We think that it would be well in such cases for them to give the public the benefit of their individual experiences without inference or exaggeration. The utility of Mr. Byng's work for the purpose he had in view, is greatly impaired by a lack of definiteness on questions of fact on subjects in which the public might have regarded him as an authority. Mr. Byng is very irate with the Government for "strengthening the monopoly which Americans hold in telephones," and adds that "the balance of the £2,000,000 voted by Parliament, which is not sunk underneath our London streets, is finding its way into the pockets of the American manufacturers." In order that the iniquity of the Government may be properly measured, the proportion of "the balance" to the total needs to be indicated.

In any discussion regarding our fiscal policy, precision of statement is essential, and any lapse into exaggeration or the use of general terms tending to prejudice is distinctly detrimental to a proper solution. It is not sufficient to commence a chapter on "Facts" with a reference to the newspapers; it is not sufficient to answer the question: "Are we (the nation) running into debt?" by giving "the opinion of a stockbroker"; or "Are we extending our shipping?" by repeating the conversation of "a shipowner." Such subjects are unquestionably within the realm of experts, but the expert statistician is an important element in the combination.

But we must stop. There is a mine of wealth for argument and analysis in Mr. Byng's book, as our readers will find for themselves. We will conclude with one further extract:—"Do we invite the foreign inventor and manufacturer to settle, and build, and work in our country, to teach our workmen, to pay our taxes, to enrich our nation? Do we protect him, foster him, tempt him with bounties and subsidies? Do we give him rewards and privileges, as our forefathers have done—as America and other nations do to-day?" And Mr. Byng answers: "We do not! On the contrary, we bribe him to stay away. We open our markets to him so that he may concentrate upon one spot abroad all his big undertakings, and reduce his average expenses and increase his profits. We give him cheaper freights and handicap against him our own manufacturers." But is there no other answer to these questions? It is true we do not invite, but we give a cordial welcome to all. We do not protect the foreign manufacturer who settles amongst us with bounties and subsidies. We do not offer him artificial supports tending to enervate his system, but we give him the protection of the fairest laws and foster his enterprise by placing at his disposal the products of the freest trade. And we give him the rewards and privileges which his works and merits may call forth. And is it true that he stays away? Are there not innumerable instances to the contrary? We do not share Mr. Byng's anxieties for his adopted country, but we recognise that the moment is a trying one for many manufacturers. There is unquestionably a danger

that the leanings of the moment and the wishes of the few may be magnified beyond their real value; but it was said half a century ago by an official of the State that "many persons persuade themselves that the life and well-being of a State are something like their own fleeting health and brief prosperity. . . . . But the State will bear much killing. It has outlived many generations of political prophets—and it may survive the present ones."

Science Abstracts. Edited by W. R. COOPER, M.A., B.Sc., Vol. iv., 1901. London: E. & F. N. Spon, Limited. Price 24s.

The arrival of the Index reminds us that the fourth volume of *Science Abstracts* is now complete. It contains 2,506 abstracts and references, which are as usual accompanied by a full index of authors' names and subjects, as well as by a supplementary index of works and installations dealt with. Over 130 journals and periodicals, representing the scientific and technical literature of all civilised nations, have come under review. The value of the work is undoubted, and it is cumulative, for with each volume the record becomes more complete and a longer period is covered.

Having successfully established the publication on a sound and lasting basis, Mr. W. R. Cooper now retires from the editorship which he has so well performed. He is succeeded by Mr. G. W. de Tunzelmann, who, we hope, will be equally successful.

WIRELESS TELEGRAPHY v. SUBMARINE CABLES.

III.

A CORRESPONDENT writing to us on "Wireless Telegraphy" commences in this wise:—"The opinions of well-known engineers on the subject reminds one very much of the opinions of eminent men with regard to the first steam engines. Some said to travel through the air (*sic*) at the rate of 20 miles an hour would mean death, while others declared that in a few years' time horses would no longer be required. Now we are trying to get to 200 miles an hour, while railway companies are the largest owners of horses." It would be interesting to learn the names of those eminent men who thought that travelling 'through the air' at 20 miles an hour spelt death, when they must have known that horsemen had from time immemorial rushed 'through the air' at that same rate if hard pressed, or when racing. Furthermore, he says:—"If Mr. Marconi has the brains to discover the means of transmitting a message across the Atlantic, it can be taken for granted that he will not be long before he overcomes all the other difficulties mentioned. How far cable companies' shares will be affected by wireless telegraphy time alone will show. To compare the present position of the cable companies with the gas companies on the advent of electric lighting is absurd, as the cable companies have not the same facilities the gas companies had of opening out in new directions when they found the electric light would seriously compete with gas. To-day heating and power would keep the gas companies independent of any lighting. What would the cable companies do if their cables were no longer required for transmitting messages? Whatever is said, nothing can minimise the importance of the new telegraphy, which is bound to affect and seriously compete with the cable companies, although there is not the slightest doubt that there is plenty of room for both systems, and, as a rule, competition does more good than harm; the cable companies will be well advised to bestir themselves to improve their systems. Many things are possible with wires for conductors that never will be possible with Hertzian waves."

These comments, on the face of them, appear to be directed against the submarine cable; but did one ever see such blowing of hot and cold with the same breath?

The remark anent the equine race goes to show that cables will multiply, notwithstanding etheric transmission of messages; the question as to what the cable companies would do if their lines were no longer required for transmitting of messages is answered by our correspondent himself, who tells us that there is room for both, and that cables are capable of many things which Hertzian waves cannot accomplish.

From his own showing, there is more in the cable than was ever dreamt of in man's philosophy; for, from experiments made by our correspondent a few years ago, he believes it to be quite within the range of possibility that whole sheets of printed matter can be transmitted over a cable as quickly as words are transmitted at the present day. Unfortunately, he could not afford the time to continue his experiments, and the world must wait for someone from America, or the Continent, as our correspondent feelingly suggests, with the idea all worked out, "as there appears more encouragement given to research abroad than in England."

The cable companies have one consolation left. Our informant does not think there are so many difficulties to overcome to attain the above-mentioned object as Marconi will have to contend with in perfecting his wireless telegraphy. The holders of cable stock may therefore take heart of grace, for it would be as unreasonable for those possessing shares in our railway companies to hurriedly sacrifice their holdings because M. Santos-Dumont has succeeded in steering his navigable air-ship around the Eiffel Tower, and promises still more startling excursions.

We will now proceed with the opinions of the experts who have so readily placed their views at our disposal, and add to those published in our second article the following caustic comments from the pen of Mr. Mervyn O'Gorman:—

"In glorifying recent wireless results it has been stated that to signal across the Atlantic implies the detection by coherer relay of $1/10^{14}$ watt as compared to $1/10^{6}$ watt for ordinary relays; this may be, but we must remember that a spark transmitter, even when the coil is supplied with only 14 amperes at 12 volts, may (as ably shown by A. A. C. Swinton) during the short period of a spark be working at the rate of some hundred H.P., and therefore the rate of working in a distant synchronous circuit need not follow an inverse square law, though the energy received may be extremely small, and may even follow that law.

"The present scare among 'submarine' shareholders has probably no relation to the sensitiveness of the Marconi apparatus. It arises from a sensitiveness which is far more pernicious to their own interests—namely, the self-conscious sensitiveness of ignorance. For, in fact, scientific men are not generally moneyed, and moneyed men not generally scientific; had they been so they would have seen that the discovery and development of a relay of amazing delicacy promises more profit to the submarine cable companies than it does to anyone else. Fortunately for them the dramatic form of direct competition which Mr. Marconi has taken may be expected to result in some movement. Large, sluggish, and prosperous commercial bodies tend to reach a placid dividend-paying but sodden state. It is never easy to know when permanent stagnancy has been reached, because even the pool of Much-Money-Got is liable to be stirred by the angelic hand of More-Money-Getting. We can ask ourselves, however, whether the world has been stirred by the published results of experiments on dielectrics, made or endowed by the cable companies. Have we any elaborate experiments on high-speed signalling such as were reported to us by Herr Lasche, of the A.E.G., on high-speed railways? Have Heaviside's, Price's, Thompson's, Lodge's or Pupin's careful and sometimes ponderous workings and results received experimental examination at the hands of the submarine companies, or has a sublime refusal of the use of the cables to the possible advancement of the world been given in view of the less speculative returns of 1s. a word?

"Electric science is so much interlocked that telegraphy is no more likely to be damaged by coherers than it was by telephones, and good management will make of these enemies a footstool. Overland the simultaneous telephone and tele-

graph has established its utility,* and adds to the value of telegraphic installations by increasing their possible output. Oversea the difficulties from interference between signalling stations is far greater than the difficulty of getting better submarine results from the present state of knowledge. Ask any scientific telegraphist whether it is more likely that the Marconi Company will attain to the present duplexed cable speeds, the present certainty and the present secrecy, or that the present cable speeds will be doubled with cables themselves ?

"In answering he will consider the following points :—

"1. That the directing or focussing of signals is quite as important in the competition and more difficult than tuning.

"2. That tuning can only be effected within a certain percentage of accuracy, say, 20 per cent. (which appears liberal), thereby allowing only five simultaneous signals to be issued anywhere within the range or cone of a receiver.

"3. That the signals from the multitude of steamers and lightships or across the French and Irish Channels and the North Sea, not to speak of uncontrollable experimenters on shore who have adopted no particular 'note,' but issue what, in the world of ether waves most corresponds to a noise, is not limited as to number.

"4. That the coherer may itself be of great use to submarine work.

"In conclusion, the wireless telegraph experiments can do nothing but good to the public, scientific and commercial; and if among these good results there is to be found the development of a highly-paid department of physicists supported jointly or severally by the cable companies, it is fairly likely that they will draw more largely than anyone else upon the wealth-producing capacity of the coherer. On the other hand, if they follow the Newfoundland policy of eviction, or even if individual irresponsible shareholders play the game lower still by maliciously creating ether disturbances, it is sincerely to be hoped that the splash created by Marconi in the still depths of the submarine world will be followed by his final and complete suppression of these undersea monsters. Underhand conduct from the companies is not any more likely than is supremacy or monopoly for Marconi."

The following very lengthy communication is from M. Emile Guarini, already well known to our readers both as an inventor in the domain of wireless telegraphy, and as a contributor to the columns of the ELECTRICAL REVIEW :—

"According to the opinions expressed by learned men and persons more or less competent to express an opinion on the subject, with regard to Marconi's last attempts in trans-Atlantic wireless telegraphy, the signals registered by the Marconi apparatus at St. John's, Newfoundland, may be attributed (1) to atmospheric electricity ; (2) to flashes of lightning in the distance ; (3) to certain wireless telegraphy stations on the American Continent ; (4) to some vessel provided with wireless telegraphy apparatus passing near Newfoundland ; (5) to practical joking ; (6) to submarine cable signals ; (7) to the opening or closing of some electric circuit, bell, &c., in the vicinity of the station ; (8) to an hallucination on the part of the watchers at Newfoundland (an hypothesis thought by many to be all the more feasible because the signals were received at the telephone) ; (9) to the station at Lizard Point.

"Thus it is assumed by some that the signals did come from England. This being the case, it is not ill-timed to consider what will be the fate of submarine cables in the more or less distant future. We know that the Anglo-American Telegraph Company gained a certain amount of notoriety at the time by interrupting Mr. Marconi's experiments so inopportunely.

"According to the daily papers, the managing director of the Anglo-American Telegraph Company remarked contemptuously :—'*Our company will continue to manufacture cables just as if Mr. Marconi did not exist.*' Are these the words of a person really convinced of the truth of what he asserts, or are they the last roars of a lion mortally wounded ? Let us note in the first place that when wireless telegraphy does compete in earnest with submarine cables, the combat will be mortal. The amounts involved in the industries connected with submarine telegraphy are enormous, and this explains the implacable manner in which the cable companies oppose in every way the efforts of the pioneers of wireless telegraphy. According to a recent report of Sir J. Wolfe-Barry, of the Eastern Extension Company, there are throughout the world 200,000 geographical miles of submarine cables, representing a sum of £41,000,000.

"But can wireless telegraphy, even in a distant future, compete seriously with submarine cables ? Why not, if it becomes as practical as ordinary telegraphy ? For this to become possible, I think that the following desiderata must be definitely realised :—

"1. Communication to any distance, by means of relays, if necessary. I may remark that whereas in direct transmission the energy to be used at the transmitter, must increase in proportion to the square of the distance, in transmission by relays, it increases in proportion to the distance. Thus, if in order to communicate from Lizard Point to St. John's, Newfoundland, intermediate stations at Cape Finisterre and the Azores were used, the energy required for the transmission would be *less than half* that required for direct communication.

"And, again, two other very important considerations must be taken into account :—(*a*) The rapidity of the transmission with two relays would be greater than with direct communication, as is the case in lines of great capacity (from Paris to Bordeaux, for instance, with the Baudot system of relays) in ordinary telegraphy ; (*b*) the total cost of installation ; the difficulties of maintaining the two extreme stations and the relay stations would be much less than those of the two extreme stations alone in the case of direct communication.

"2. The limitation of the space in which the electrical waves are propagated, this propagation being effected as surely as that of the current along the conducting wire in ordinary telegraphy. The metallic screens (*Comptes Rendus de l'Académie des Sciences de Paris*, Vol. cxxxi., pp. 540-541, No. 13, 1900), the Hertzian reflectors, the refractors, and, lastly, the plane surfaces and the sheaths (English patent 1,555, January 24th, 1900), are examples of limitation and concentration of the electro-magnetic waves used in wireless telegraphy.

"3. Great speed of transmission, for instance, by means of the multiplex telegraphy already realised by Marconi and Mr. Slaby.

"4. A very economical use of the energy employed effected by the concentration of the electric waves, and by the use of alternating or intermittent currents which suppress the energy uselessly expended as light and heat in the spark.

"I have before my eyes a very interesting document. It is nothing less than a letter from the managing director of a certain cable company, in which he criticises—in his own way, be it understood—wireless telegraphy.

"Thus, as a beginning, he tells us : 'As the cost of the wire is *comparatively small*, I suppose the object of your efforts to establish communication without wires is to provide the public with a means of communication more rapid than those now in existence, viz., the telegraph and telephone.' It was the intolerable slowness of the telegraph that brought about the adoption of the telephone, as it was also the intolerable slowness of the telegraph and the telephone that induced endeavours to find a still quicker means of communication. Thus the cards are shuffled again, and motives are attributed to us that have never even been thought of. Who ever said that the object of wireless telegraphy is to communicate more rapidly than with the ordinary telegraphy. The cost of the wire in ordinary telegraphy is *comparatively small*. Pardon, but comparatively to what ? To wireless telegraphy ?

"This is nonsense. In wireless telegraphy, the wire costs nothing, for there is none, whereas, in ordinary telegraphy, each kilometre of the line (single wire) costs on an average 700 francs, and there are countries, like the Argentine Republic, where it costs from 1,000 to 1,500 francs, and others, like the Congo Free State (see M. Mahieu's pamphlet : 'Le Télégraphe et le Téléphone au Congo.') In submarine telegraphy, which is of special interest to my correspondent, each

* Van Rysselberghe's Patent 323,239, U.S.A., July 23rd, 1885, also Beach and Roseburgh's Patent 212,433, U.S.A.

kilometre of submarine cable costs

$$\frac{225{,}400{,}000}{200{,}000 \times 1{,}852} = 608 \text{ francs},$$

according to Sir J. Wolfe-Barry's data.

"The advantage of wireless telegraphy consists in the suppression of the wire itself, which constitutes the most onerous part of a telegraph line. Thus, even admitting the figures 608 fr. per km., a cable between Lizard Point and St. John's, Newfoundland—*i.e.*, of a length of 3,350 km. (in reality it is much longer, since 3,350 km. is the distance in a straight line—on following the curve of the sea—whereas the cable lies on the undulating bottom of the sea, which is often several kilometres, nay, even tens of kilometres, deep)—would cost 608 × 3,350 = 2,036,000 fr., whereas the two trans-Atlantic Marconi stations—which are the first that have been made for such long distances, and which will, no doubt, be considerably simplified shortly, have cost about 378,000 fr., or about one-fifth of the cost of the cable.

"And what about the laying, testing, and maintenance of the cable, which items require ships constructed for the service alone? And when the cable breaks and the ship is stopped? In wireless telegraphy there are none of these drawbacks and additional expenses, as there is no line.

"Then my correspondent, who shows himself very friendly to the writer, goes on as follows:—'I wish you complete success in your researches, but, at the same time, I should like you to know what can be done with ordinary telegraphy, with a little energy, and to form a correct appreciation of the instantaneousness of electricity even with wires. We are now transmitting, and have for several years been transmitting, messages between London and New York, (4,000 miles) by a simple duplex wire, and we cable at the rate of 600 messages an hour. These messages occupy from 45 seconds to a minute the whole day long, and we have sent as many as 2,200 messages in 4 hours. With our vast experience in telegraphy, we are certain that this is the most rapid transmission in the world, and while wishing you success, we doubt very much whether wireless telegraphy will ever do as much.'

"It is not for us to cast the horoscope of wireless telegraphy, but we will discuss what can be done now, after the remarkable, yes, undoubtedly remarkable, in spite of everything and everybody—experiments of Mr. Marconi.

"It is not long since Mr. Marconi, and Mr. Slaby also, by rendering transmitters and receivers special as regards their electrical factors, so as to make the transmitters emit vibrations of a certain order, and to render the receivers sensitive to these vibrations only, succeeded in working *10* transmitters connected with the same antenna. They each send their message to one only of the *10* receivers, placed side by side, and also requiring only one receiving antenna, or scattered in space.

"Moreover, it is known—or if it is not known, we will make it known, or remind those who have forgotten—that the mean speed of transmission by wireless telegraphy is 10 words a minute. Let us see what conclusions can be drawn from these poor 10 words a minute, supposing that the 10 transmitters and the 10 receivers thus syntonised are placed at London and New York, and are all 10 working at the same time. Each series of 10 transmitters, for instance, the London series can transmit to the corresponding series of 10 receivers at the other station—New York, for instance—100 words a minute, and 6,000 words an hour, or, reckoning 5 words per message, 1,200 messages an hour, or just double what my correspondent can do with his duplex cable. And, again, in his case, the messages can be transmitted in one direction only. If we could do what is not possible at present, but will shortly be, *i.e.*, make the two double series of 10 apparatus work *simultaneously*, we should get 2,400 messages an hour, *i.e.*, just four times what can be done with the duplex cable.

"It is true that he also speaks of the absolute secrecy of ordinary telegraphy. Although this is not altogether borne out in practice—De Wet is an instance in point—since it is only necessary to cut or tap the wire and put it into communication with the apparatus of the person who wishes to surprise the communication, as has been effected in South Africa, we will accept his statement, feeling that we have said enough. We will return to the subject when the fitting moment has arrived. It is true that Marconi still owes us a decisive proof of his trans-Atlantic wireless communication, but, according to rumour, we shall not have to wait long for it.

"However this may be, if trans-Atlantic communication without conducting wires has not yet been established, it will be, either directly or by means of intermediate stations, if not to-day, to-morrow. Some may contradict this, but they cannot show that they are right.

"Step by step, we shall succeed in accomplishing what, seven years ago, would have seemed a dream; without wire, without any conductor, to send our thoughts with lightning rapidity 7,000 km. And in the meantime wireless telegraphy, as Prof. Slaby said at the conference held by him at Kiel some months ago, will, in many cases, replace submarine telegraphy. Services between two points where the intercourse would be too limited to be remunerative with cables, or between two points where it is impossible, for instance, to lay a cable owing to the nature of the bottom of the sea, are undoubtedly applications reserved for wireless telegraphy. Perhaps it will also be found expedient to use wireless telegraphy whenever a new means of communication is required to a distance easily accessible by wireless telegraphy.

"But there is another application of quite a special order, and not of a nature to excite the susceptibilities of submarine cable companies, who, moreover, ought to recognise, in this application at least, a faithful ally in telegraphy through space. In fact, on several occasions, when the exigencies of the service are too great, and the existing cables are not sufficient, these companies have to face the alternative of laying another cable, which sometimes costs some millions of francs, or of paying an enormous price for a new apparatus capable of transmitting a few words more per minute. In such contingencies, it seems to me that if these companies would instal a supplementary service of wireless telegraphy, it could be used when all the cables are at work, or when any accidental breakage occurred in the cable, in which case all communication would be interrupted.

"If, on the other hand, wireless trans-Atlantic communication has really been established, the submarine cable companies must, in my humble opinion, look to their laurels, as the future looks very dark for them. In short, who can say that wireless telegraphy cannot make such advances—the long-distance problem being solved across the sea—as to compete actually and in earnest from all points of view with submarine cables? My correspondent has said that humanity is always seeking something better, something new, and requires it to be provided as economically as possible. Nothing is immovable in nature, everything is in process of transformation. Do we not see automobiles taking the place of animal traction, the horse being superseded by the electrical horse-power? Happy are those who know how to accommodate themselves to the progress of the age instead of having recourse to bluster and recrimination.

"Let us wait therefore and see which will prevail: ordinary telegraphy or wireless telegraphy. However this may be, we hope with all our hearts with regard to submarine cables—those poor eels lying along the bottom of the sea—that the retreat will soon be sounded, and that they will go to enrich some museum of antiquities, already stocked with other electrical relics, the Pacinotti dynamo, the Volta pile, the chemical telegraph, and many other marvels justly celebrated in their day, but now possessing only a great historical value."

We yield to no one in our admiration of Signor Marconi and his remarkable work, and Mr. Guarini's eulogy of the distinguished Italian does infinite credit to the warmth of his nature. But Signor Marconi, as a great inventor, is one thing; the exploiting of his discoveries is another.

Mr. Guarini, however, when he discusses the possibilities of wireless telegraphy allows his imagination to run riot, as his reference to the desire of his heart plainly shows. Moreover, it does not appear certain whether he quite appreciates the fact that duplexing a cable is for the very purpose of enabling, and, of course, *does* enable, messages to be sent to and fro at the same time.

He also mixes up land lines with cables in so delightfully confusing a manner that it is by no means easy to follow his arguments.

Still, we are not contending that wireless telegraphy may not go ahead by leaps and bounds; our efforts have been devoted to showing that the great depreciation in the shares of cable companies, due, it is said, to Marconi's success, is utterly at variance with the true nature of the situation.

Mr. Marconi was recently entertained at dinner by the American Institute of Electrical Engineers, and the post-prandial speeches give a kind of clue to the future.

The illustrious inventor confessed that his trans-Atlantic experiments would have been continued but for bad weather conditions. The submarine cable is indifferent to climatic influences!

He referred to the claims of the Anglo-American Cable Company to the right over land and sea, and he spoke appreciatively of the action of the British Government, which, although claiming a monopoly of the telegraph, encouraged his experiments instead of preventing them.

He hoped that, at no very distant date, he would so perfect his apparatus as to allow of communication across the ocean at small expense, as at present the cost of laying cables is so great, that the companies have to charge a high price for the service.

Wireless telegraphy, he said, would cheapen the cost very considerably, and do away with all cables and the charge for their maintenance, but Dr. Pupin, who knows, perhaps, as much as any of the American *savants* who took part in the discussion of the possibilities of both systems, stated with emphasis that he did not consider wireless telegraphy would ever prove sufficient of a competitor to submarine telegraphy to endanger the present investments in that industry. In this connection we may call the attention of our readers to the speech of Sir J. Wolfe Barry in our report of the Eastern Telegraph Company in our "City" columns. Here endeth the third lesson!

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1902.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London W.C., and at Liverpool, to whom all inquiries should be addressed.

868. "An improved fitting and reflector for carrying electric and other lamps and lights." C. M. STEAD. January 13th.

873. "Improvements in electrical railways of the conduit or enclosed supply system." J. MILNES. January 13th.

914. "An improved electric arc lamp for light-cure purposes." R. OTTO. January 13th. (Complete.)

918. "Improvements in or relating to electrical measuring instruments." R. S. WHIPPLE. January 13th.

948. "Improvements in portable electrically-driven rotary apparatus suitable for use as a rotary hair or other brush, and for grinding, polishing, cutting, and like purposes." J. A. COLE. January 13th.

947. "An apparatus to give alarm by means of an electric bell in the event of a locomotive running past a signal at danger." B. J. CHUBB. January 14th.

952. "Improvements in means for upholding broken electrically-charged or 'live' wires." W. BARNES. January 14th.

993. "Improvements in or relating to telegraph and telephone wires." J. WOMERSLEY and G. W. WOMERSLEY. January 14th.

999. "Improvements in electrically-controlled railway switches." E. DE PASS. (The Cheatham Electric Switching Device Company, United States.) January 14th. (Complete.)

1,021. "Improvements in electric switches." W. H. CHIPPERFIELD and E. S. COOK. January 14th.

1,027. "Improvements in and relating to electric railways." E. W. FARNHAM. January 14th. (Complete.)

1,028. "Improvements in and relating to electric railways." E. W. FARNHAM. January 14th. (Complete.)

1,057. "Improvements in and relating to electric signal lamps and the like." H. D. BARLOW. January 14th.

1,061. "Improvements in or relating to telegraphic apparatus." F. G. CREED and W. A. COULSON. January 14th.

1,067. "Improved covering for trolley pole base or tram top cover." E. DEIGHTON. January 15th.

1,077. "Improvements in a process and apparatus for the manufacture of white lead from pig lead by electro-chemical fusion." E. BAILEY and A. CROWTHER. January 15th.

1,078. "Improvements in electrical railway signalling." E. WILFORD and G. W. TAYLOR. January 15th.

1,104. "Improvements in or relating to dynamo-electric machinery." A. B. SOAR. January 15th.

1,126. "Improvements in methods of generating electrical energy." A. WASSILIEFF. January 15th.

1,136. "Improvements in lighting carbons." A. G. SIEMENS BROS. & Co. and H. VIERTEL. January 15th. (Complete.)

1,139. "Improvements in the manufacture and production of electric batteries of the kind known as dry batteries." H. W. BUTLER. January 15th.

1,142. "Improved means for enabling a number of electric circuits at a distance to be made and broken periodically as required, the invention being applicable to the operation of multi-rate or ordinary meters, arc or incandescence lamps, transformers, demand indicators, and other apparatus." E. SCHATTNER. January 15th.

1,161. "Improvements in and relating to electric signalling and telephonic communications with railway trains, electric lighting, and railway couplings." J. DAY. January 16th.

1,229. "Improvements in telegraphs." W. D. KILROY. January 16th.

1,238. "Improved collector rings for electrical machines." THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, LIMITED. (Communicated.) January 16th.

1,239. "Electric fan for use in theatres and other places." H. AGHA. January 16th.

1,241. "Improvements in means for regulating the voltage in installations worked by alternating currents." L. G. CHEVRIER. January 16th.

1,251. "Improvements in and relating to electricity meters." W. M. MORDEY and G. C. FRICKER. January 16th.

1,267. "An invention for insulating metal covers for electric switches to prevent short circuits." G. H. BRICKNELL. January 16th.

1,274. "Improvements in electrical transmitters and receivers." T. D. DUNDAS. January 16th.

1,313. "Improvements in and relating to surface contact systems for electric traction." A. RAST. January 16th.

1,322. "Combination door knocker and electric alarm." J. GRIFFITHS. January 16th.

1,343. "Improvements in electric fuses." CALLENDER'S CABLE & CONSTRUCTION COMPANY, LIMITED, and H. HASTINGS. January 17th.

1,351. "An improved process for purifying and bleaching liquids, more especially saccharine liquids, by electric dialysis in conjunction with a halogen (chlorine)." O. SPILLERN-SPITZER. January 16th.

1,355. "Improvements in the construction of conduits for underground more especially intended for use in systems of underground electric traction." T. E. DEVONSHIRE. January 16th.

1,402. "Improvements in apparatus for operating the points of overhead electric tram wires." H. COLLINS and C. W. COLLINS. January 18th.

1,417. "A new or improved electric meter." F. WYATT. January 17th.

1,435. "Improved coupling joint or connection for electric wires and fittings." M. RAILING and G. H. IDE. January 17th.

1,441. "Improvements in or relating to the means for adjusting or regulating the shades, reflectors, or screens, employing in connection with adjustable or other electric lights, gas lights, and others for the purpose of concentrating and diffusing the light therefrom in any desired or required direction, for the purpose of facilitating photography and apparatus therefor." N. S. KAY. January 17th.

1,446. "Improvements in automatically signalling by electricity between trains on railways, and braking and apparatus for that purpose." O. IMRAY. January 17th. (Communicated.)

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1900.

3,390. "Improvements in or relating to type-writing, type-setting, or analogous machines." H. Dundas and P. B. W. Kershaw. Dated February 21st, 1900. Relates to machines for use in connection with type-writers, linotype machines, type-composing machines, telegraphic apparatus, &c., or for perforating paper strips for controlling typographic apparatus.

3,441. "Improvements in and relating to telephonic communication and signalling." M. Byng and F. G. Bell. Dated February 21st, 1900. Relates to an arrangement of apparatus for direct-call telephone systems and to fire alarm telegraph-call systems. The call box and connections are arranged as described in Specification No. 2,350, A.D. 1899, except that the call post bell may be shunted to prevent sparking.

3,481. "Improvements in and relating to resistances for electric circuits." L. Newitt. Dated February 22nd, 1900. A liquid resistance has a movable hollow electrode constructed to float when lowered into the electrolyte, and to sink slowly as liquid passes into it through a small hole; when it is raised the liquid may escape quickly through a number of holes, passing a downwardly-opening flexible rubber flap valve. The holes are formed in a wooden portion in the cylindrical electrode, which also carries a buoyant ring.

3,501. "Improvements in electric alarums." W. C. Hill. Dated February 22nd, 1900. The parts of the alarum are contained in an air-tight casing so that it can be used in a damp or dusty atmosphere in mines, ships, chemical works, &c. Sound is produced by an adjustable hammer striking against the sides of the casing or diaphragms attached thereto.

3,524. "Improvements in features for the anodes in electrolytic apparatus." W. P. Thompson. (H. Becker.) Dated February 22nd, 1900. Relates to means for cleaning galvanised, nickelled and tinned iron and other scrip.

3,532. "Improvements in electric rollers for therapeutical and massage purposes." J. W. Gibbs, of New York, U.S.A. Dated February 22nd, 1900. Relates to an electric roller for massage and therapeutic purposes. A roller mounted in insulated bearings in a forked metallic handle carries a series of magnets which are rotated by the roller round a fixed armature comprising a metallic core, a wire winding and metallic longitudinal strips. One pole of the armature is connected to the handle, the other being connected by a plate to the roller. By this arrangement the rotation of the roller caused by the massage action induces a current through the body.

3,527. "Improved adjustable for electric alarm clocks." H. Hansen (of Germany). Dated February 22nd, 1900. For utilising any clock to sound an electric alarm, an insulating piece bearing a binding screw and a connected pallet for the hour hand to make contact with is mounted anywhere on the bezel by a spring clip.

3,534. "Improvements in electric supply meters." Evershed & Vignoles, and S. Evershed. Dated February 22nd, 1900. Motor meters are made with magnetically-supported vertical spindles, the arrangement adopted being a modification of that described in Specification No. 9,127, A.D. 1897, and with commutator armatures arranged astatically in opposite magnetic fields.

3,535. "Improvements in electricity meters and electric clocks." G. Hookham, of Birmingham. Dated February 22nd, 1900. Clocks and electro-magnetically controlled pendulum electric meters are driven by continuous current electric motors of any form, or by alternating current induction motors, such as are described in Specification No. 17,159, A.D. 1899. The escapement wheels are connected to their shafts by springs, in order that the motors may start freely and accumulate sufficient energy to start the pendulums. A pendulum clock is shown with an induction motor. The motor shaft carries a conductive disc between two pairs of straight pole-pieces, which extend vertically across considerable portions of the disc, as in the alternating current motor meter described in Specification No. 2,683, 1896. The two pole-pieces are parts of an electro-magnet carrying an inner coil to which an approximately constant alternating current is supplied, and also an outer secondary coil. The other pole-pieces are parts of a magnet having a winding supplied from the secondary coil. The motor shaft drives the spring winding shaft of the clock by a pinion, an intermediate wheel, and a loose wheel carrying a pawl in engagement with a ratchet wheel fixed on the winding shaft. The spring maintains the motion of the clock for some time if the motor stops. The clock may be provided with means for electrically setting the hands to true time, or indicating true time, signalled from a central station.